
LEGENDS IN UROLOGY

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Perfecting Nerve-sparing Radical Prostatectomy: Sailing in Uncharted Waters

I'm not certain where I first heard this expression, but I have lived with the philosophy that if you have been given the privilege to sail in uncharted waters, you have the *responsibility* to make those charts. I am grateful to Dr. Gabriel Haas, Editor-in-Chief of The Canadian Journal of Urology, for his invitation to discuss my philosophy of discovery. Previously I provided a detailed description of the discovery of the cavernous nerves and the initial development of nerve-sparing radical retropubic prostatectomy.¹ However, that was just the beginning. Over the next 25 years there were twenty-seven other discoveries or adaptations that increased my understanding of the anatomy and made it possible to improve the surgical technique. I thought it might be of interest to review the process of these discoveries in an effort to encourage others to understand that discovery is never over – everything can be made better.

The impetus for this analysis was provided by Dr. Peter Wiklund's invitation to discuss this topic at the Karolinska Institute in November 2007. Under his leadership, the Karolinska has the largest experience in robot-assisted radical prostatectomy in Europe. His unit is making an effort to correlate changes in surgical technique with their impact on quality of life and cancer control. As background for his studies he asked me to describe the process I used over the last 25 years.

The first purposeful nerve-sparing radical prostatectomy was performed on April 26, 1982. Twenty-six years later this patient is cancer free and has a normal quality of life. However, not every patient has experienced a perfect outcome and for this reason I made a conscious effort to use the operating room as an anatomy laboratory to evaluate minor changes in surgical technique that I thought might have a major impact on outcome.

The key to perfecting the technique began on day one by developing a database that included anatomical observations, changes in technique, cancer control and quality of life. To facilitate the collection of data and assure excellent patient care I spoke to all patients every 3 months on the telephone evaluating their outcomes and coaching them to recovery until they were satisfied. In doing this I told myself the truth, by dictating exactly what the patient said when asked "are you wearing a pad" and "have you been able to have intercourse more than 50% of the attempts." The correlation between the database and an independent third party questionnaire was shown to be 95%.²

Next, I surrounded myself with colleagues. Jonathan Epstein is the pathologist who protected the patient from the surgeon. Leon Schlossberg, a famous medical illustrator at Johns Hopkins, was more than a medical illustrator—he was an anatomist. By having him watch the operations and discuss the findings, we were able to develop a detailed understanding of the anatomy surrounding the prostate and identified minor anatomical details that were important to perfecting the surgical technique.

Next, the role of my residents cannot be underestimated. Herb Lepor was instrumental in providing cadaveric material on adults so we could understand the precise neuroanatomy of the pelvis and Peter Schlegel, using fresh cadavers, extended these observations. These early residents and the ones who followed helped chart the outcome of patients and the impact of surgical technique on quality of life and cancer control.

Finally and probably most importantly, were my patients who were my partners in discovery. They were always available to honestly share their own outcomes so that others might benefit.

Armed with the database and surrounded by colleagues the approach to perfecting the technique was very simple. I merely changed one thing at a time, and constantly reevaluated what I was doing. Ultimately, I used video documentation to teach others and to teach myself. I made twenty-seven major observations or changes in the surgical technique. Table 1. I will highlight a few of them.

After performing over 100 patients I suddenly realized that it was possible to widely excise the neurovascular bundle on one side thus producing a wider margin of excision than was previously possible using the perineal technique. I also learned that many men with preservation of only one neurovascular bundle were potent.

Next beginning with patient #120 I noted that the percent of patients who were potent at 1 year declined from roughly 70% to 30%. At this time I realized that with upward traction on the catheter I was placing excessive traction on the neurovascular bundles as they were being released from the prostate. This prompted me to selectively ligate the vascular branches in the mid portion of the prostate using very small bites. Next, in sequence was mucosal eversion at the bladder neck to reduce bladder neck contractures, direct division of the posterior striated sphincter to improve surgical margins, preservation of aberrant anterior pudendal arteries, and refined division of the dorsal vein complex. I realized that using the McDougal clamp oftentimes was associated with inadvertent entry into the anterior prostatic tissue or excessive excision of the striated sphincter. To avoid this, in July 1996 I initiated a technique where I partially divided the puboprostatic ligaments, used figure-of-eight ligation of the dorsal vein complex incorporating the perichondrium, and divided the dorsal vein and striated sphincter under direct control.

TABLE 1. Perfecting the technique: sequential modifications of radical prostatectomy 1982-present

Date	Patient number	Description
September 1984	#110	Wide excision of the neurovascular bundle
March 1985	#160	Fine ligation of the branches of the NVB
April 1985	#166	Mucosal eversion at the bladder neck
September 1987	#474	Vicryl instead of chromic for anastomotic sutures
October 1987	#485	Bulldog clamps on hypogastric arteries
April 1988	#567	Accessory/Aberrant pudendal artery recognized
January 1989	#672	Direct division of the posterior striated sphincter
January 1989	#678	Lateral pedicle divided but not ligated
October 1989	#785	Intermittent compression devices on lower extremities
June 1990	#883	Preservation of aberrant anterior pudendal artery
February 1991	#989	Nerve graft series initiated
March 1995	#1680	Six urethral sutures
March 1995	#1688	Vicryl replaced by Monocryl
June 1996	#1497	McDougal clamp discontinued
July 1996	#1963	Refined division of the dorsal vein
March 1997	#2087	Video documentation; Viagra
September 1997	#2202	Pubic stitch
November 1998	#2425	Release of peritoneum
May 1999	#2545	Closure bladder neck/new stoma on anterior bladder
June 1999	#2553	2.5 power loupes
August 1999	#2587	Division umbilical ligament
August 2000	#2766	Stopped traction on bladder with malleable blade
October 2000	#2801	Bladder neck intussusception
May 2003	#3275	Babcock clamp to stabilize the anastomosis while tying the sutures
December 2004	#3558	4.5 power loupes
January 2005	#3581	8 cm incision
June 2005	#3649	High anterior release of the neurovascular bundle

In 1997 I prospectively videotaped surgical procedures on sixty potent men. Eighteen months later I reviewed the videotapes and correlated specific steps in the surgical procedure with patient reported recovery of sexual function. This identified four separate minor differences in surgical technique that appeared to improve outcomes.³ However, I was disappointed that I was unable to identify any step during the apical dissection that was associated with early recovery of urinary control. At 3 months 55% of men were wearing no pads. For this reason over the next 800 patients I attempted to see whether modifications at sites other than the apex might be helpful. I undertook the following sequential changes: complete release of the peritoneum from the bladder to avoid traction; when this failed to help I over sewed the bladder neck creating a new stoma on the anterior bladder turning it down to produce a bas-fond that I felt might buffer increases in intraabdominal pressure; division of the umbilical ligament to further reduce traction on the bladder; and finally, I stopped placing the urethral sutures into the adjacent striated sphincter. None of these made a difference. However, immediately after I began performing bladder neck intussusception 80% of the patients were dry at 3 months. In a recent study at 1 year 98% of patients were wearing no pad and 100% of patients stated that they had little or no problem.^{4,5}

In recent years I began using 4.5 power loupes, decreased the size of the abdominal incision to 8 cm in an effort to improve cosmesis and to avoid excessive traction on the bladder with a malleable blade, and most recently developed a technique for high anterior release of the neurovascular bundles which provides superior recovery of sexual function at 12 months (93% of men who preoperatively had normal SHIM scores are potent at 12 months and 70%-78% have SHIM scores greater than 21).⁶

I've always told people that I would retire when all patients were continent and potent at 3 months. Hopefully one day I will achieve those results. However, I'm convinced that the operating room can be used effectively as an anatomy laboratory, that minor variations in surgical technique can have a major impact on outcomes, that intraoperative videos provide objective documentation of surgical technique, and that repeated reevaluation of outcomes correlated with changes in surgical approach is the best way to reduce morbidity and improve cancer control.

In keeping with the philosophy of making charts, I have consistently documented my anatomical observations and changes in surgical technique in textbooks and articles and several years ago embarked upon a 4 year project in which I developed a one hour and forty-five minute DVD that provides a detailed description of the surgical technique. This DVD has now been distributed free to 50,000 urologists around the world who have requested it. This has been a labor of love and reinforces my belief that any gift that we have been given must be shared with others. I appreciate the invitation to share these thoughts with you.

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