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# Medicine & Health RHODE ISLAND

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Minimally Invasive Urology

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## Commentaries

### Best Medical Schools

While one can have a “best” in a competition, it is generally not possible to label a “best” in most endeavors. Many years ago I addressed the issue of “best doctors” in RI, chosen in different ways in different years, but always with a mechanism that heavily weighted the selections to doctors in Providence. National lists of best doctors are based more on national or regional reputations, which biases the selections in favor of those in academia, since most doctors get known outside their small circle by virtue of publications or lectures.

Rating medical schools is much harder, I think, so I was surprised a few years ago when a dean of the medical school stated that one of his targets was to get Brown among the top 25 on *US News and World Report's* ratings of American medical schools. It reminded me of the annual rating of American colleges in which there was apparently some meaning attached to being ranked number one versus number two. In my mind this is akin to deciding that tuna is number two to salmon in a list of edible fish.

Colleges have responded to this ranking by advertising to solicit more applications in order to reject more students in order to appear more selective, or accept fewer students and have larger wait lists in order to have a smaller percentage of students who choose other schools. Neither element is related to quality, of course, but are criteria used in ranking. Some schools have withdrawn from the competition and do not provide information to this cockamamie scheme.

So why should Brown care about a news magazine's ranking? I don't have an answer. The dean also wanted Brown to increase its NIH funding, an outcome I can understand. More research money not only translates into more research, hence more publications and prestige, but it also lures more and better faculty, enhances the financial state of the departments involved, the medical school and the community. It also creates opportu-

nity for biotech research in the area, which will have its own synergistic effects on the medical school.

Research funding is taken into account in the rating of medical schools but I'm unsure how important it really is in terms of medical training. I guess the bottom line for me is that not only do I not know what it means for one medical school to be better than another, but I'm skeptical that anyone does.

I remember counseling a cousin who was admitted to Einstein and Columbia medical schools. Which one should he choose? I had gone to P & S (Columbia) and my wife to Einstein. After a discussion of the pros and cons of both I opined that Columbia, which I liked a lot, was probably “better” in most areas. Both had excellent clinical training programs, a deep supply of “interesting” patients, lots of “hands on” opportunities, a faculty highly devoted to teaching. Columbia had a greater depth of research opportunities and teaching by famous experts, but Einstein was more community-oriented with a much greater emphasis on primary care and community health. My cousin chose Einstein, and is now an associate chair of a department of social medicine. Which was better? Columbia has never failed to top Einstein on the “best” list but in what sense was it better?

Most of the factors by which we rate medical schools cannot be reflected in a rating scale. One cannot compare teaching, only evaluations of teaching. It is an experiment without a control or cross over group. Students don't take lectures at two schools in the same topics and compare them. The curricula are generally pretty standard. One school might take an “innovative” approach to teaching, reflecting the pedantic ideology of the day, but newer isn't necessarily better. “If it ain't broke don't fix it.” One can, perhaps, rate the interest level of the faculty, an undoubted marker, in my mind, for a good course, or one can look at national exam scores or pass rates, but these two

are obviously confounded by the fact that the more selective school, by virtue perhaps of higher standing on a “best” list, gets students who do better on standardized exams. After all, we don't know what makes a good doctor, other than compassion, knowledge and judgment, none of which do we know how to rate. In addition, “teaching to the test” is a good way of producing good test results, but not necessarily enhancing education. This has been one of the most important criticisms of the “No child left behind” initiative in public education. Another benchmark might be who teaches the courses, seasoned and famous faculty or new instructors without reputations. On the one hand the former may be world class, drawing on great insight and teaching experience, or old geezers giving the same lecture for twenty years. Are the new instructors motivated and excited, or annoyed because they're being taken away from their research which will determine whether they can keep their jobs?

I think rather than taking a magazine's rating as something we'd even want to consider, we can either sample a large number of medical school faculty to develop a “prestige” list, which is not the same thing as a “best” list, or we can take an approach I saw on a Yale sweat shirt. On the front it states, “Harvard sucks,” and on the back, “and Princeton doesn't matter.”

— JOSEPH H. FRIEDMAN, MD

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# Family Values In the White House

**Countless books have portrayed the lives of those chosen by** the American electorate to occupy the White House, rent-free, for four-year intervals. There is hardly an aspect of the family lives of the 43 past presidents that hasn't been dissected and scrutinized, yielding battalions of tomes, texts, exposes and doctoral theses. But this being October, one month before when elections are customarily held, a further demographic glance at the presidential families might seem justified. This is a time in American history when family values have become a transcendent issue, deemed by many to be more important even than national security.

Forty-three men, not all elected to the presidency, have occupied the White House (or its residential equivalent): One resolute bachelor (Buchanan) and 42 married. (Grover Cleveland had also begun his presidency as a bachelor but married Frances Folsom in the second year of his term.)

The resolutely single president, James Buchanan, had been engaged to Ann Coleman of Lancaster, Pennsylvania, 38 years prior to his elevation to the Presidency; sadly, though, she died of an overdose of laudanum (opium) and Buchanan never entertained thoughts of marriage again.

Four of the 42 married presidents were childless (Washington, Madison, Jackson and Polk). Interestingly, three had married widows (Martha Washington and Dolley Madison) or divorcees (Jackson). Rachel Doleson Jackson had been married to Lewis Robards but she misinterpreted the Virginia legislative right to divorce as an actual divorce. Her subsequent marriage to Jackson was thus transiently bigamous until she obtained a legal separation in 1793.

James Polk's childless marriage may possibly be ascribed to a childhood medical event. At age 17, suffering from severe abdominal pains, he was taken to the office of Dr. Ephraim McDowell in Danville, Kentucky. In 1812, when neither anesthesia nor aseptic surgery were known, McDowell operated on Polk, using brandy as an anodyne. Some history texts claim that Dr. McDowell removed gall stones, but recent inquiries indicate that he extracted bladder stones. When incising through the perineum, Dr. McDowell may have inadvertently interrupted the tubular pathways carrying semen, thus rendering Polk sterile. The surgery was otherwise successful and Polk went on to an eminent career as congressman, Speaker of the House and this nation's eleventh president, the first born in North Carolina.

Six of the 42 married presidents were married twice (Tyler, Fillmore, Harrison, Theodore Roosevelt, Wilson and Reagan.) The second marriages of Fillmore, and Reagan were childless while Theodore Roosevelt's second marriage yielded five children, Benjamin Harrison's second marriage produced one child, and John Tyler's second marriage resulted in seven children (in addition to the seven children born to Letitia, his first wife.)

And the wives of the Presidents? The wives of Washington, Jefferson, Madison and Jackson had been previously married. The wives of Wilson, Harding and Kennedy survived their husbands' deaths and were subsequently married. Some of the

presidents, including Cleveland and Wilson were married while living in the White House. Three presidents became widowers while in office: Tyler, Benjamin Harrison and Wilson. And six former first ladies are still alive: Elizabeth Ford, Rosalynn Carter, Nancy Reagan, Barbara Bush, Hillary Clinton and Laura Bush.

Martha Jefferson, Rachel Jackson, Hannah van Buren, Ellen Arthur and Alice Roosevelt died before their husbands assumed the presidency. Jane Wyman was divorced from her husband, Ronald Reagan, before his election to the presidency.

And the known children of the first 43 presidents? Ninety male and 62 female babies were born to those elected to the White House, a total of 152 offspring. The male:female ratio was 1.45, substantially greater than the general newborn 1.05 ratio in this nation. Of the first ten presidencies (Washington through Tyler), there were an average of 4.6 offspring per president. In the next ten presidencies (Polk through Garfield), there were an average of 3.9 offspring per president. In the next ten presidencies (Arthur through Hoover), there were an average of 3.0 offspring per president. In the final 12 presidencies (Franklin Roosevelt through George W. Bush) there were 3.1 offspring per president.

Can anything be concluded from these meager statistics? The fecundity of those elected to the Presidency seems to have diminished since the office was established in 1789; the number of children per American family has gradually decreased in the 22 decades since Washington's inauguration, for a variety of cultural and medical reasons including a drastically reduced infant mortality rate leading to more prudent family planning. The presidential fecundity may be little more than a reflection of a general trend. The increasing stress of the office must also be considered. And as a corollary observation, the deeper significance of which will require a more intensive scrutiny, namely: Presidents aligned with the Republican party are more fertile than Democrats.

— STANLEY M. ARONSON, MD

## Disclosure of Financial Interests

Stanley M. Aronson, MD, has no financial interests to disclose.

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# The Role of Minimally Invasive Urology In the New Millennium

Gyan Pareek, MD

The field of urology has experienced tremendous advances in the new millennium. Technological innovations in optics and instrumentation have helped shape the area of **minimally invasive urologic surgery (MIUS)**. In the past, operations for prostate cancer, kidney cancer and stone disease involved large incisions, significant blood loss and long hospitalizations with high patient morbidity. The evolution of laparoscopy, robotics and percutaneous surgery has propelled a paradigm shift.

Traditionally, the Rhode Island health care arena has dedicated more attention and resources to surgical subspecialties such as cardiac, vascular, orthopedics and neurosurgery. Recently, the focus has shifted, with much more investment in urology. The transition is likely due to a number of factors, including the aging population, the high incidence of prostate cancer diagnosis, stone disease and **benign prostatic enlargement (BPE)**.

The importance of a regional investment in the field of urology is sensible when considering that 250,000 cases of prostate cancer will be diagnosed this year in the United States; more kidney disease

will be detected with the increased improvement in radiographic imaging; and an estimated 2 billion dollars will be spent in the management of kidney stones. In addition, the number of persons aged 90 years or older is expected to increase from 9.3 million to 19.5 million between 2000 and 2030 in the United States. This will likely lead to a further rise in the incidence of urologic health issues.

Since my arrival in Rhode Island in 2005, robotics has had the greatest impact locally, with over 600 robotic prostate procedures performed in a 2 year period. Rhode Island has the fastest growing robotic surgery program in the United States. Furthermore, laparoscopy has also experienced tremendous growth, with over 200 laparoscopic kidney procedures performed in the last 2 years. In the area of stone disease, 99% of cases are managed utilizing MIUS techniques. BPE has also undergone significant change, with an armamentarium of minimally invasive techniques for patients who have failed medical therapy. Finally, the introduction of novel treatments such as penile rehabilitation have further enhanced care for men.

In this issue of *Medicine & Health/Rhode Island*, we provide an update on the various MIUS techniques and clinical experiences, with a focus on laparoscopic-assisted robotic urologic surgery, BPE therapy and the minimally invasive management of stone disease. The reader is provided with a special report on Men's Health, concentrating on post prostate surgery penile rehabilitation. The goal of this issue is to educate the reader on the advances in MIUS and to emphasize the cutting edge urologic medicine practiced in Rhode Island.

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The author has no financial interests to disclose.

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# The History of Robotics In Urology

*Sutchin R. Patel, MD, and Gyan Pareek, MD*

In 1921 the playwright Karel Capek coined the word “robot” in his play, “Rossum’s Universal Robots”. The word is derived from the Czechoslovakian term “robota” which means forced work. Capek’s play dealt with a world in which robots help humans with everyday tasks but eventually turn on their masters.<sup>1</sup> Isaac Asimov wrote numerous science fiction stories on robots and was the first to use the term “robotics.” His works centered on robots’ interactions with society and inspired many of today’s fictional books and movies. However, over the past decades the bridge between science fiction and reality has closed. The first digitally operated and programmable robot, the Unimate, was installed in 1961 to lift hot pieces of metal from a die casting machine and stack them. This was the beginning of the use of robotics in industry. Robots have since been used in manufacturing, assembly, packing, transport, space exploration, laboratory research, weaponry and surgery.

A surgical robot has been defined as “a computer-controlled manipulator with artificial sensing that can be reprogrammed to move and position tools to carry out a range of surgical tasks.”<sup>2</sup> The field of urology has become increasingly technology driven and thus has been on the forefront of surgical robotics.

Modern surgical robotic systems can be categorized into off-line (fixed-path) and on-line systems. Off-line systems are automated robots that execute precise movements based on pre-programmed imaging studies obtained before surgery, without active input from the surgeon. These include robots for prostate access such as the ProBot (Imperial College, London), an endoscopic robotic resection device for the prostate and renal access systems such as the PAKY device (Johns Hopkins Medical Institute).<sup>3,4</sup>

On-line robotic systems (also known as master-slave systems) were designed to replicate the surgeon’s movements in real time within the operative field. In the 1980s, the National Aeronautics and Space Administration Ames Research Center investigating virtual reality systems

collaborated with mechanical engineers at the Stanford Research Institute (SRI) interested in robotic technologies to develop a “telepresence” surgical system to improve dexterity in microscopic hand surgery.<sup>5,6</sup>

## Leonardo da Vinci... is credited for having drawn and built the world’s first robot in 1495.

The focus then shifted from microsurgical to macroscopic general surgical applications, largely driven by the demonstration of laparoscopic cholecystectomy in 1989 by Perissat and colleagues.<sup>7</sup> A revised telepresence system including a surgeon’s console and remotely controlled telemanipulators was developed with funding from the US Department of Defense. However, rather than using a laparoscopic approach this system was used initially to perform open surgery and was intended to be a battlefield surgical system for combat casualty care. The concept included a mobile, armored, operating room vehicle equipped with robotic surgical manipulators that were controlled remotely by a surgeon at a rear-area mobile surgical hospital unit.<sup>8</sup> The licensed commercial rights to the SRI Green Telepresence Surgery Systems were then used to found Intuitive Surgical Systems in 1995. After further development, a renovated master-slave clinical system was released in April 1997 as the da Vinci surgical system. In July 2000 the Food and Drug Administration (FDA) approved the da Vinci surgical system. Unlike its predecessor, the da Vinci system was intended solely for laparoscopic surgery as opposed to open surgery.<sup>6</sup>

Intuitive Surgical Systems named its robotic system after Leonardo da Vinci because he is credited for having drawn and built the world’s first robot in 1495. Leonardo’s robot wore a suit of armor, typical of 15<sup>th</sup> century German-Italian design. It had a flexible neck and a jaw that could

open and close. It could sit up, turn its head, wave its arms and make sounds to the accompaniment of automated drums. The hips, knees and ankles operated with 3 degrees of freedom, while the shoulders, elbows, wrists and hands operated with 4 degrees of freedom. Da Vinci’s detailed anatomical drawings allowed him to design pulley systems to emulate the complex joints and muscles of the human body.<sup>9</sup> The range of motion of the wrist presented challenges to robot design but, using da Vinci’s principles, engineers were able to construct a suitable model. Although the name da Vinci has become synonymous with the robotic prostatectomy, ironically, in all of his anatomical drawings, Leonardo da Vinci never identified the prostate. This was thought to be due to the fact that his anatomical dissections for the genitourinary system were performed on castrated oxen which would thus have atrophic prostates.<sup>10</sup>

The ROBODOC used to mill out precise fittings in the femur for hip replacements was the first robotic surgical device marketed when it was introduced in 1992 by Integrated Medical Systems.<sup>11</sup> The next commercially available device was the Automated Endoscopic System for Optimal Positioning (AESOP) created by Computer Motion. Released in 1993, this intern-replacement robot allowed hands-free automated control of the endoscope. The surgeon interacted with the system using a directional microphone thus using both voice and foot controls. Soon after, Computer Motion released its own master-slave system, the Zeus Surgical System which received FDA approval for limited abdominal operations in October 2001.<sup>12</sup> Building on its original AESOP technology, two-surgeon-controlled robotic telemanipulators were added. In June 2003, Intuitive Surgical and Computer Motion merged to combine their intellectual property and market and support product lines from both former companies.<sup>1,13</sup>

Robotic systems subsequently have been used to perform a number of urologic procedures including radical prostatectomies, nephrectomies, pyeloplasties,

cystectomies, adrenalectomies and pelvic floor procedures. Like all technologies there is a tradeoff between the benefits and drawbacks. General limitations include the high costs involved in acquiring the systems and the set-up times involved. Haptic feedback is lacking, thus the surgeon cannot make decisions based on tension and texture and must compensate with visual cues.<sup>1,6</sup> These drawbacks are not static, however, and will decrease as the technology matures. One of the most prominent benefits of robotic surgery is the increased manual dexterity of the instruments along with motion-scaling and tremor-filtering functions. The robotic systems are ideally suited for constrained spaces such as the pelvis for prostatectomies. The optical capabilities including stereoptic vision along with magnification provide a three-dimensional image. Additional benefit is also derived from the ergonomic control stations used to interface these systems leading to decreased fatigue and strain on the surgeon.<sup>1,6</sup>

Endoscopic and laparoscopic surgery are a large part of urology, thus our field lends itself favorably to advances in technology. Though urologists have been quick to harness the potential of this generation of surgical robotics we should also be meticulous in our evaluation of these new technologies. We are still in the early phases of the robot revolution with advances already occurring in flexible robotics, mobile *in vivo* robots, advances in endoscopic navigation and in haptic feedback and remote robotic surgery.<sup>14</sup> We expect to see exciting developments as technology evolves to suit our surgical needs.

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# Robot-Assisted Laparoscopic Urologic Surgery

Michael S. Lasser, MD, Lanna Cheuck, DO, Joseph Renzulli, MD, and Gyan Pareek, MD

**Minimally invasive surgery has grown** exponentially over the last two decades. With smaller incisions, reduced blood loss, shortened hospital stay and time to convalescence, and reduced postoperative pain, laparoscopy has gained momentum as the preferred approach to many surgical procedures. This is especially true in the field of urology where minimally invasive approaches to nephrectomy, adrenalectomy, pyeloplasty, and prostatectomy have become commonplace.

Despite this exponential growth, complex laparoscopic procedures remain a daunting task. In urology this is particularly true with regard to pelvic surgery (i.e. prostatectomy), due to the small operative space, lack of depth perception secondary to 2-dimensional vision, and rigid instrumentation utilized in laparoscopy. The incorporation of robotics into surgical procedures has helped to allay several limitations of standard laparoscopy. With approximately 70% of radical prostatectomy operations performed utilizing a robot-assisted approach in 2008, it is clear that robotics have been well received in urology.<sup>1</sup> With its increased utilization, **robot-assisted laparoscopic (RAL)** surgery has now expanded to renal surgery. As they are incorporated into surgical approaches to the kidney, the hope is that the benefits of RAL pelvic surgery will directly translate to better outcomes in renal surgery.

## THE DA VINCI ROBOTIC SURGICAL SYSTEM

The first reported incorporation of robotics into surgery was in 1985 when Kwoh et al. used a robot to aid in drilling and biopsy during computed tomography-guided brain surgery.<sup>2</sup> Surgical robots were first utilized in urology in 1989 when a robot was implemented during transurethral resection of the prostate.<sup>3,4</sup> Currently the only commercially available surgical robot is the da Vinci system (Intuitive Surgical, Sunnyvale, California).

Surgical robots fall into one of 3 cat-

egories: (a) active; (b) semiactive; and (c) master-slave systems.<sup>5</sup> In an active system the robot performs the procedure autonomously. A semiactive system incorporates both autonomous and surgeon-driven elements. Finally, a master-slave system is one in which the surgeon is in complete control of the robot from a remote station. The da Vinci robotic system is a master-slave system: the surgeon resides at a console separate from the patient, but within the same operative suite, and directly manipulates the robot to perform the surgical procedure.

The da Vinci system consists of an operator console and a patient side robotic tower that houses 3 to 4 surgical arms. These consist of a central arm that holds the camera and 2 or 3 instrument arms. The camera incorporates two separate lenses to provide a 3-dimensional visual field for the operating surgeon and also

provides up to 10x magnification. In addition to the improved visualization, the instrument arms provide the surgeon with 7 degrees of freedom allowing for movements that mimic a human wrist. (Figure 1) These advantages help to filter out human tremors, provide the surgeon with a comfortable position from which he or she will operate, and provide for more facile intracorporeal suturing.

Despite the benefits of the da Vinci surgical robot, there are disadvantages. The initial cost of the system exceeds \$1.5 million; and the instruments have a limited life, with 10 uses allowed at a cost an average of \$180 for each use.<sup>6</sup> Also, robotic surgery does not provide the surgeon with haptic feedback: the surgeon must rely on visual cues, requiring a learning curve during manipulation of instruments and tissues.

**Table 1. Patient Data**

Mean Demographic Data (Range)		
Age	60.4 (43-74)	
BMI	27.7 (19-41)	
ASA Score	2.2 (1-6)	
Oncologic Data		
Mean PSA	5.6 (0.1-30)	
Mean Prostatic Volume	40.9 (14-130)	
Preoperative Gleason Score		
Mean	6.4 (5-9)	
2-6	202	
7-10	120	
Pathologic Staging		
T2a	54	
T2b	3	
T2c	210	
T3a	37	
T3b	15	
T4	1	
Operative Characteristics		
Mean Console Time (min)	180.3 (48-480)	
Intra-Operative Transfusions	1	
Post-Operative Transfusions	10	
Mean Length of Hospitalization (days)	2.26 (1-23)	
Postoperative Positive Margins (%)		
All	62/322	(19.25%)
T2	40/267	(14.98%)
T3	22/52	(42.31%)

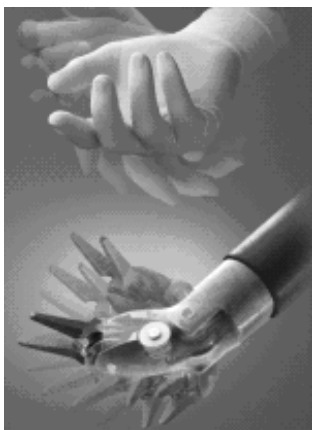


Image 1: Endowrist articulated instruments with 7 degrees of freedom. 2005 Intuitive Surgical, Inc. [Image courtesy of intuitivesurgical.com 2009]

### ROBOT-ASSISTED LAPAROSCOPIC RADICAL PROSTATECTOMY (RALRP)

Prostate cancer is the most common non-cutaneous malignancy of men in the United States. In 2009, an estimated 240,000 new cases will be diagnosed, with approximately 80,000 cases (33%) considering **radical retropubic prostatectomy (RRP)** as their treatment. Traditionally, RRP has been performed with an open midline incision from below the umbilicus to the pubic bone, often associated with significant hospital stay and blood loss. Recently, **robot-assisted laparoscopic radical prostatectomy (RALRP)** has become the preferred approach for those patients undergoing the operation. In 2008, an estimated 70% of RALRPs were performed robotically.<sup>1</sup> As the national and international experience has evolved, the literature on various urologic robotic experiences has rapidly grown. Clearly, surgeons are accepting and adopting the technique as first-line surgical treatment for prostate cancer.

In Rhode Island, RALRP has been performed since December 2006. Throughout this experience, over 600 radical prostatectomies have been performed robotically. The Rhode Island program is among the fastest growing robotic programs in the United States. A total of 322 of these procedures were available in our database for review at the time of this report (Table 1). Of these, the mean age was 60.4 years with a **body mass index (BMI)** of 27.7. The average prostate volume and PSA of our patients

were 40.9 cubic centimeters and 5.6 ng/mL, respectfully. Throughout our operative experience our mean console time, as a surrogate for operative time, was 180.3 (48-480) min. Overall, 87% of patients underwent nerve-sparing techniques for preservation of potency. Only 1 patient required an intra-operative blood transfusion and a total of 10 patients necessitated a postoperative transfusion. When our data were examined more closely, however, in our last 83 patients there have been no intraoperative transfusions and only 1 (1.2%) postoperative transfusion. When hospital data were reviewed, the mean length of stay was 2.26 days of which 25.8% had <24 hr hospital stay, significantly less than the 2-4 day hospital stay previously observed with open radical prostatectomy. Our patients experienced an overall complication rate of 17.4%, with a major complication rate of 4%.

Since early 2007, the Rhode Island experience is in line with the international and national experience, with regards to safety and efficacy. There has been a significant impact on the number of prostate surgeries done in Rhode Island, with a quadrupling of the cases done at the Miriam Hospital in 2008.

### ROBOT-ASSISTED LAPAROSCOPIC NEPHRECTOMY (RALN)

The first reported RALN was by Gill et al.<sup>7</sup> in 2000. In this report the Zeus robotic system (a bed-mounted master-slave system that is no longer commercially available) was utilized to perform a nephrectomy on five pigs. The procedures were performed uneventfully with an average operative time of 85.2 minutes. The success of this procedure prompted the utilization of the Zeus system to perform a nephrectomy on a human. A simple nephrectomy was performed on a hydronephrotic kidney without intraoperative complications and an operative time of 200 minutes.<sup>8</sup>

Thereafter, surgeons expanded use of the da Vinci surgical system to renal surgery. RAL nephroureterectomy,<sup>9</sup> radical nephrectomy,<sup>10</sup> and donor nephrectomy<sup>11</sup> have been described. In 2005 Klinger et al.<sup>10</sup> reported their single institution initial results with da Vinci robotic radical nephrectomy. Of five men undergoing the procedure (median age 72) there was

a single conversion to hand-assisted laparoscopic nephrectomy due to bleeding, and no perioperative morbidities or mortalities were observed. The authors concluded that RALN is a viable alternative to open and laparoscopic nephrectomy but warrants larger comparative studies prior to widespread utilization. Unfortunately, no large prospective or randomized trials exist and the available series and case reports have failed to show any significant advantage over conventional laparoscopic techniques.<sup>12</sup>

In the literature the use of robotics in donor nephrectomies continues to be among the largest ongoing reports of RALN. Renoult et al.<sup>11</sup> reported the first series of RAL donor nephrectomy performed completely with the da Vinci system in 13 patients. The authors compared this experience with 13 open donor nephrectomies performed at the same institution. The authors documented no intraoperative complications in both groups and the duration of hospitalization was significantly decreased in the RAL group. Despite this, a significantly increased operative time, warm ischemia time, and cold ischemia time were experienced with the RAL approach. These authors determined that there were no adverse effects and the grafts from both groups were found to have similar 5-day creatinine clearance.

Further prospective, randomized studies are necessary to delineate the utility of the RALN. Standard of care in Rhode Island remains laparoscopic radical nephrectomy, without robot-assistance.

### ROBOTIC-ASSISTED LAPAROSCOPIC PARTIAL NEPHRECTOMY (RALPN)

Open nephrectomy is considered the standard of care for management of both small and large renal cell carcinomas. Recently, however, laparoscopic partial nephrectomy has developed into an ideal procedure for patients with exophytic small (< 4cm) renal masses. In addition, as experience with minimally invasive surgical techniques has grown, patients with larger or multiple tumors, especially in the setting of diminished renal function and genetic predisposition, are being offered nephron, sparing surgery.<sup>13,14</sup>

RALPN has developed as a modality to facilitate hemostasis, tumor excision, and renal reconstruction that present sig-

nificant barriers to laparoscopic partial nephrectomy. The first report of RALPN was in 2004 by Gettman et al.<sup>15</sup> in which 11 transperitoneal and 2 retroperitoneal RALPNs were performed without intraoperative complications. In this series there was one postoperative ileus and RCC was found in 10 cases. One positive margin was identified; however, a subsequent nephrectomy demonstrated no residual cancer on final pathology.

In 2005 Phillips et al.<sup>16</sup> reported their technique for RALPN and demonstrated it as a feasible, safe, and reproducible procedure in 12 patients with a mean tumor size and EBL of 1.8 cm and 240 mL, respectively. This technique, in which the robot is docked after standard laparoscopy is used to mobilize the kidney and renal hilum as well as expose the tumor capsule, was then employed in 10 patients and subsequently compared to 10 patients undergoing conventional laparoscopic partial nephrectomy at the same institution.<sup>17</sup> The authors found no significant differences in operative time, ischemic time, EBL, hospital stay, change in creatinine, and change in hematocrit between the two groups. All patients in both groups had negative intraoperative margins. On final pathology, however, a single patient with oncocytoma in the laparoscopic group was found to have a positive margin. They concluded that further study is needed to determine the advantages of RALPN over conventional laparoscopy and added that they no longer perform RALPN at their institution.

From these studies and the additional literature, it is clear that RALPN is a safe and feasible procedure. What remains unclear is whether or not it provides any advantages over the conventional laparoscopic approach that has been adopted at many centers. Larger randomized series will be necessary to answer these questions. Locally, we continue to employ the laparoscopic method partial nephrectomy, although a robotic protocol is being formulated for more complex and intrinsic lesions.

## ROBOT-ASSISTED LAPAROSCOPIC PYELOPLASTY (RALP)

When the advantages of the da Vinci surgical robotic system are scrutinized, it is clear that the system is most beneficial in a reconstructive setting where

intracorporeal suturing is extensive and precision is paramount. This advantage is evident during RALP.

The Anderson-Hynes dismembered pyeloplasty has become the gold standard for the management of UPJO with a reported success rate of 95-99%. The success rates of RALP range from 89-100% and compare favorably with the open gold standard.<sup>18</sup>

An initial report of the utilization of the Zeus robotic system to perform pyeloplasty in a porcine model generated interest in RALP.<sup>19</sup> These authors determined that the use of the robot resulted in increased anastomosis times, but the "tightness" of the repair, when compared to laparoscopic suturing, was equal. In a follow-up study the Zeus system was compared to the da Vinci system for performing various procedures in the porcine model. The da Vinci robotic system allowed the surgeon to complete the anastomosis faster and secure it with more bites.<sup>20</sup>

In the initial human experience the Anderson-Hynes dismembered pyeloplasty was performed in 9 patients using the da Vinci robotic system with an overall subjective and objective success rate of 100% at mean follow-up of 4.1 months.<sup>21</sup> Gettman et al.<sup>22</sup> later compared RALP to standard laparoscopic pyeloplasty: 6 patients in the RALP group were compared to similar laparoscopic patients. The patients treated with a robotic approach had a shorter operative time and suturing time. When blood loss, hospital stay, and complications were compared, however, there were no differences between the groups. This robotic series was updated 2 years later with 49 patients.<sup>23</sup> Mean operative time and estimated blood loss were 124 min and <50 mL, respectively. Outcomes were reviewed in 41 of these patients with a mean follow-up of 7.4 months: there was 100% success on diuretic renal scan or IVP.

In the largest RALP series to date Dr. Patel reported results on fifty patients undergoing dismembered pyeloplasty with at least 11 months of follow-up:<sup>24</sup> there were no complications and blood loss was minimal. The patients were followed with diuretic renal scan at 1 month, every 3 months for 1 year, every 6 months for a second year, and annually thereafter. Of the 50 patients, 48 (96%) had both objective and subjective improvement.

The RALP has been proven technically feasible and safe, with outcomes that are equivalent to those of laparoscopic pyeloplasty. The advantages of shorter hospitalizations and operative times as well as the added facility of intracorporeal suturing and enhanced visualization make the da Vinci robot exceptionally equipped for reconstructive procedures, including RALP. At the Miriam hospital, we have an active RALP program, with approximately 20 procedures performed over the last 2 years.

## CONCLUSION

Since the advent of robotic surgery, the utilization of the da Vinci robotic system in urologic surgery has grown exponentially. The literature documents an ongoing effort to broaden its utilization and delineate its benefits in urologic practice. The technology's benefits are most evident in procedures requiring maneuverability within a confined space and meticulous suturing, making it ideal for reconstructive procedures and pelvic surgery. Long term prospective comparisons with open and laparoscopic procedures are needed to further define the role that robotics will have in the future of urology.

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# Penile Rehabilitation After Radical Prostatectomy

Akanksha Mehta, MD, and Mark Sigman, MD

The widespread use of PSA testing has led to an increasing number of men being diagnosed with early stage prostate cancer, and at younger ages. **Radical prostatectomy (RP)** is a definitive treatment option for these patients, with excellent long-term results. Despite the advances made with nerve-sparing surgical techniques and the use of robotic-assisted laparoscopic procedures, the incidence of post-prostatectomy **erectile dysfunction (ED)** remains significant. Return of erectile function is not immediate, and may occur over 6 months to 4 years. In the Prostate Cancer Outcomes Study approximately 60% of men were impotent 18 months after RP; at 5 year follow-up, only 28% of men reported erections firm enough for intercourse, either with or without an erectile aid.<sup>1,2</sup> Literature published over the last decade shows widely disparate rates of erectile function and dysfunction following RP. The incidence of complete ED, partial erectile function, and intact erectile function after RP ranges from 26-100%, 16-48%, and 9-86%, respectively.<sup>3</sup> It is important to understand that after radical prostatectomy the ability to achieve the sensation of orgasm is not affected. However, ejaculation of seminal fluid no longer occurs since the seminal vesicles and prostate are absent. Patients will generally experience a "dry" orgasm although some patients may leak a small amount of urine with orgasm or secrete a drop of clear pre-ejaculate fluid from the glands of Litre in the urethra.

With a decreasing average age at prostate cancer diagnosis and an increasing number of radical prostatectomies performed annually, postoperative sexual function is an important concern for many patients. In a prospective cohort of 580 patients treated with RP, external beam radiation therapy or brachytherapy for localized prostate cancer, sexual bother was much more common than urinary or bowel bother at all time points, regardless of the primary therapy.<sup>4</sup> Some patients value sexual function so highly that they choose prostate cancer therapy that offers better potency with lower life expectancy than vice versa.<sup>5</sup>

Patient age, preoperative potency status, and extent of neurovascular bundle preservation have been identified as factors predictive of potency recovery after RP.<sup>6</sup> Penile rehabilitation after radical prostatectomy has been advocated as a means of preserving erectile function following surgery. We review the pathophysiology of post-prostatectomy ED, the rationale for early penile rehabilitation, and the current strategies.

## **PATHOPHYSIOLOGY OF POST-PROSTATECTOMY ED**

The normal erectile process involves relaxation of the smooth muscles in the corpora cavernosa of the penis, leading to increased blood flow into the penis. As a result of the engorgement of the corporal tissue, venous drainage out of the corpora is compressed against the tunical coating of the corpora, leading to decreased venous outflow (veno-occlusion).<sup>7</sup> At the molecular level, cavernosal smooth muscle relaxation is dependent on **nitric oxide (NO)** from cholinergic nerve endings or sinusoidal endothelium, which then activates cGMP pathway. **Phosphodiesterases (PDE)** interfere with this process by hydrolyzing cGMP.

Radical prostatectomy leads to an extended period of intracorporal hypoxia, due to decreased arterial flow and chronic absence of erections. Penile hypoxia impairs NO synthesis and promotes collagen synthesis and cavernosal fibrosis. Progressive cavernosal fibrosis leads to veno-occlusive dysfunction and increased venous leak in affected patients. These changes result in permanent ED and may also cause the penis to shorten due to scar tissue.

Etiologies of ED following RP include nerve injury, arterial trauma, and veno-occlusive dysfunction.<sup>8,9</sup> Some degree of neuropraxia occurs even in bilateral nerve-sparing RP, despite meticulous surgical dissection. The recovery of nerve function occurs slowly over 6 months to 4 years, as neuropraxia resolves.<sup>10</sup> Arteriogenic ED occurs due to the transection of accessory pudendal arteries, which can be difficult to visualize or preserve at the time of RP. Decreased

arterial inflow leads to penile hypoxia and contributes to penile fibrosis and disuse-related corporal smooth muscle atrophy. Venous leak, or corporal veno-occlusive dysfunction, is the most common form of ED after following RP.<sup>3</sup>

## **RATIONALE BEHIND PENILE REHABILITATION**

Penile rehabilitation is a program to improve penile healing in an attempt to increase the chance of return of erectile function after prostate cancer therapy, by increasing cavernosal tissue oxygenation, and decreasing tissue fibrosis and apoptosis. In 1997, Montorsi postulated that early postoperative use of alprostadil injections into the penis to induce erections would lead to increased corporal oxygenation and avoid structural changes in corporal tissue related to prolonged absence of postoperative erections.<sup>11</sup> In this small randomized study of three times weekly intracavernosal alprostadil (PGE1) vs. no treatment, potency in the treatment group was 67% vs 20% without treatment. During erection, oxygen tension in the corpus cavernosum changes from 30-40 mmHg in the flaccid state to 70-100 mmHg in the erect state.<sup>3</sup> Cavernosal oxygenation is therefore considered important for erectile tissue health. The early use of hyperbaric oxygen therapy in rats after cavernosal nerve injury showed an increase in the intracavernosal pressure-to-mean arterial pressure ratio from 30% on room air to 55% on hyperbaric oxygen.<sup>12</sup>

Animal studies demonstrate a protective effect of phosphodiesterase inhibitor (PDE5-i) therapy on cavernosal smooth muscle mass.<sup>13</sup> Rats subjected to bilateral cavernosal nerve resection develop corporal fibrosis and veno-occlusive dysfunction. When treated with PDE5-inhibitors, researchers noted an increase in smooth muscle content vs. collagen, normalization of veno-occlusive dysfunction, and a decrease in the smooth muscle apoptotic index.<sup>14-17</sup> In animals, both functional and structural consequences of cavernous nerve injury can be ameliorated by PDE5-i therapy.

The data in humans have been mixed. A randomized controlled study of nightly sildenafil vs. placebo in 76 men after nerve-sparing RP demonstrated markedly increased return of spontaneous erectile function after 36 weeks in the sildenafil group (27% vs. 4%).<sup>18</sup> Unfortunately, researchers did not study the outcomes beyond one year and the potency rate in the placebo arm was lower than historical controls. The use of PDE5-i therapy has also been associated with improved histological outcomes. In men receiving sildenafil every other night after RP, no significant differences were noted in collagen or smooth muscle content 2 and 6 months after RP compared to preoperative biopsies, indicating prevention of cavernosal fibrosis.<sup>19,20</sup> While the primary goal of penile rehabilitation is to promote the return of spontaneous erectile function, a secondary goal is to improve the ability of patients to become responders to erectogenic medications. In a study comparing outcomes in men who underwent penile rehabilitation with either sildenafil or intracavernosal injection therapy (ICI) vs. those who did not, preservation of erectile function was noted in 52% of the rehabilitation group vs. 19% in the non-rehabilitation group 18 months postoperatively.<sup>21</sup> Furthermore, penile rehabilitation improved patient response to sildenafil (64% vs. 24%) and ICI (95% vs. 76%), and resulted in a significantly earlier response to sildenafil compared to no rehabilitation.<sup>21</sup> Together, results from the above studies provide evidence to support early institution of penile rehabilitation after RP.

### **THERAPEUTIC OPTIONS FOR PENILE REHABILITATION**

Early treatment options for erectile dysfunction after RP include oral PDE-5 inhibitors, intraurethral medications and intracavernosal injections (PGE1, papavarine, and phentolamine combinations), and **vacuum erection devices (VED)** without the constriction ring.

Interest in the use of VEDs in penile rehabilitation protocols stems from its high patient compliance rate and its affordability, due to insurance approval. A randomized study of the daily use of VED vs. no treatment after RP demonstrated significantly improved erections

for both nerve-sparing and non-nerve-sparing RP patients who used VED compared to controls.<sup>22</sup> Even a single use of VED after RP increased corporal and glanular oximetry relative to baseline.

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## **Some patients ... choose prostate cancer therapy that offers better potency with lower life expectancy than vice versa**

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RP has a significant impact on penile length and girth, with some decrease in penile stretch length reported in up to 71% of patients, and a mean reduction in penile volume of 22%.<sup>23-25</sup> Nerve-sparing surgery and recovery of erectile function have been shown to have an independent protective effect on penile length loss.<sup>26,27</sup> The early use of a VED has been shown to reduce the likelihood of significant penile shortening from 48% in historical controls to 3%.<sup>28</sup>

Alprostadil may be more effective than oral PDE5-i for the early treatment of erectile dysfunction after RP because it does not require nerve function.<sup>29</sup> A controlled study of the early use of intraurethral alprostadil three times weekly after RP demonstrated significantly improved IIEF-5 scores, more frequent sexual activity, and greater return of natural erections sufficient for vaginal intercourse at 9 months postoperatively in patients who used alprostadil vs. patients who did not use any treatment.<sup>30</sup> Recent data also suggest that low dose nightly alprostadil significantly increased flaccid penile oxygen saturation when compared to sildenafil.<sup>31</sup> Disadvantages of alprostadil therapy include urethral irritation, cost, and lack of insurance coverage.

The use of oral PDE5-i for penile rehabilitation has been associated with preserved corporal smooth muscle mass and decreased fibrosis, as described above. A recent meta-analysis clearly demonstrates improvement in erectile function in two-thirds of participants and successful intercourse in 28-50% of participants.<sup>32</sup> The optimal dose and frequency of dosage of

PDE5-i therapy has not been established. On the contrary, two recent studies evaluated the efficacy of a nightly or every-other-day PDE5-i regimen compared to a regimen of using the medication only when attempting sexual activity (on-demand dosing). No difference was demonstrated between the two regimens.<sup>33-36</sup>

ICI, although highly effective at inducing erection, has the obvious side effects of being invasive and potentially painful. While studies have shown that combination therapy using ICI and oral PDE-5i facilitates early sexual intercourse and earlier return of spontaneous function, and high success rates even in the setting of other medical comorbidities, patient compliance is low.<sup>7, 37</sup>

### **THE BROWN UNIVERSITY EXPERIENCE**

Most penile rehabilitation programs combine erectogenic therapies to optimize patient compliance as well as cost and therapeutic outcome. At the Men's Health Center at Miriam Hospital patients are seen for an initial consultation 4-6 weeks after radical prostatectomy. Our rehabilitation regimen consists of daily use of a VED for 10 minutes, without a constriction ring, and three times weekly intraurethral administration of compounded Trimix gel (alprostadil, phentolamine and papaverine) for the first postoperative year. Patients are encouraged to try oral PDE5-i on a monthly basis to assess for return of any erectile function. Sexual activity is encouraged, whenever desired by the patient and his partner, and PDE5-i or intracavernosal injection therapy is prescribed when required as an erectogenic aid to allow for sexual activity during the rehabilitation program.

### **FUTURE DIRECTIONS**

More studies are needed to determine optimal dosing, type, and frequency of medications for the rehabilitation programs. Whether on-demand medication to induce erections for sexual activity are as effective as nightly or several night per week medication in return of erectile function remains controversial. Recent studies have suggested a potential role for erythropoietin in erectile preservation due to its role as a neurotrophic agent and a stimulator of erythropoiesis under hypoxic conditions.<sup>38</sup>

## CONCLUSION

Despite the limitations of the clinical studies, including short follow-up, small number of patients, retrospective nature, or lack of consistent controls, the popularity of penile rehabilitation after RP is growing. No perfect regimen yet exists, and the choice of regimen will need to account for cost, effectiveness and patient compliance.

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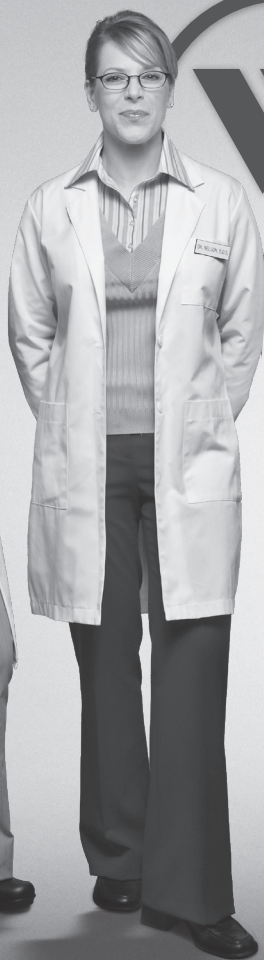
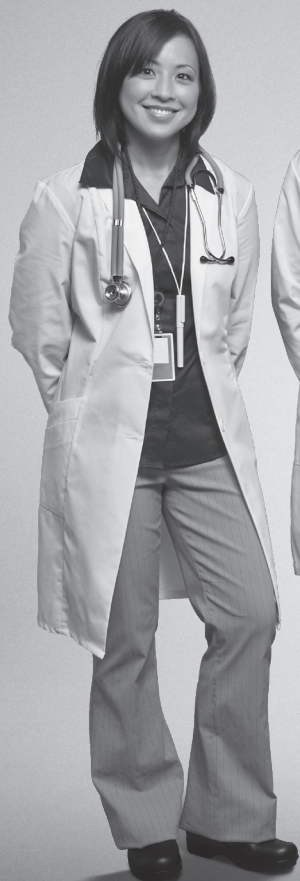
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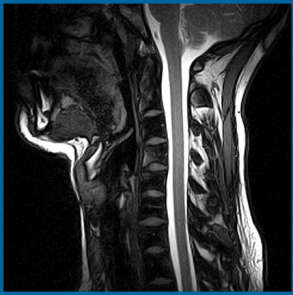
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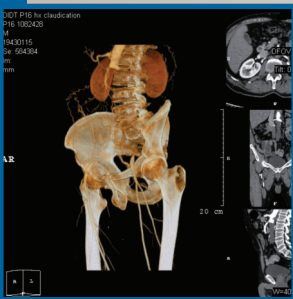


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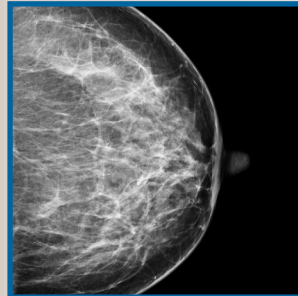
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# Update On Minimally Invasive Therapies for Benign Prostatic Hyperplasia

George A. Turini III, MD, and Gyan Pareek, MD

## Benign prostatic hyperplasia (BPH)

is, and will remain, increasingly common with aging. Histologically it has been identified in 50% of patients by age 50, and in 80% of 80 year olds.<sup>1</sup> The excessive growth of prostatic stromal and epithelial cells causes **benign prostatic enlargement (BPE)**. With continued growth, however, BPE can evolve into **benign prostatic obstruction (BPO)**, a condition often associated with bothersome **lower urinary tract symptoms (LUTS)** that worsen an individual's quality of life.<sup>2</sup> **Transurethral resection of the prostate (TURP)** has been considered the gold standard for treating patients with significant urinary symptoms related to BPH.<sup>3</sup> Unfortunately, along with this technique come the risks of undergoing an invasive surgical procedure necessitating general anesthesia. To this end, new and more **minimally invasive techniques (MIT)** have been developed. This review examines some of the minimally invasive options available for treating BPH and the criteria used to determine which are used.

In general, minimally invasive therapies for BPH produce symptomatic and objective results more slowly compared to surgical procedures.<sup>3</sup> Whereas surgery can definitively eliminate obstructing tissue as a source of the problem, MIT require a longer process wherein prostatic tissue damaged by energy breaks down and reabsorbs naturally over time. Often, such a compromise in recovery speed is acceptable to men with mild LUTS as an alternative to hospitalization and/or more serious complications related to surgery. In addition to this figurative "refractory" period in which therapeutic results are not immediately apparent, MIT generally share similar side-effect profiles including: urgency, irritation, and post-procedural swelling<sup>2,3</sup>. Retention secondary to swelling can be avoided with catheterization or alpha-blocker therapy. Occasionally, volume of ejaculate may be decreased following MIT, particularly when the bladder neck is intruded upon during the intervention.

## WATCHFUL WAITING

Many men elect not to pursue medical or surgical therapy for their BPH, instead opting for a strategy termed "watchful waiting." This is the least invasive management strategy available for this condition and a reasonable approach in patients with minimal prostatic enlargement and mild LUTS.<sup>4</sup> It has been suggested that "active surveillance" is a more accurate phrase for this option than "watchful waiting" because the latter connotes a passive absence of intervention. In reality, patients are evaluated each year with a **digital rectal examination (DRE)**, assessment of symptoms, and a PSA level. Uroflow and PVR volumes may be beneficial as well.<sup>2</sup> Additionally, behavioral modifications such as timed-voiding and limiting intake of caffeinated and alcoholic beverages have been shown to reduce the effects of LUTS in patients with BPH.<sup>5</sup> Watchful waiting has emerged as a recommended therapeutic option for patients with minimal impairment in quality of life secondary to their symptoms.<sup>6</sup>

## TRANSURETHRAL MICROWAVE THERMOTHERAPY

This form of minimally invasive surgery can be completed with local or oral pain medication in an outpatient setting. During the procedure, a catheter with an antenna is placed in the prostate gland and microwave energy is subsequently delivered to heat and destroy the overgrown prostate tissue via coagulation necrosis. The body then reabsorbs that tissue, thereby returning the gland to a more normal size. In guidelines published in 2004, the AUA states four transurethral microwave heat treatment devices (CoreTherm®, Targis®, Prostatron®, TherMatrx®) are effective options for managing LUTS associated with BPH. Despite individual variations in level of energy delivered, cooling mechanism and method of temperature reporting, the AUA panel did not find a significant difference in outcome among the devices. The FDA, however, did report complica-

tions in patients treated using cooled thermotherapy appliances, emphasizing the need for physicians to be present and adherent to safety protocols.<sup>6</sup> The pooled mean urinary symptom score following TUMT decreases less dramatically compared to TURP (65% v 77%). The incidence of retrograde ejaculation, TUR syndrome, blood transfusions, hematuria and strictures requiring intervention was less among patients undergoing TUMT compared to TURP, but transurethral resection was associated with fewer cases of urinary retention, dysuria and re-operation.<sup>7</sup> It has been reported that small prostate size, advanced age, low levels of total energy delivered and mild obstruction scores can serve as predictive factors to identify poor responders to TUMT.<sup>8</sup> In other investigations, however, using different devices, predictive factors were not concordant thus making attempts to create a uniform and generalized set of outcome predictors a difficult task.<sup>9</sup> Recently, studies have sought to evaluate the durability of 30 minute TUMT treatment compared to 60 minute treatment.<sup>10,11,12</sup> Although length of time and type of device used have been inconsistent in the literature, there appears to be a slight increase in the need for retreatment among patient undergoing the 30 minute protocol compared to 60 minutes.<sup>11</sup> Ultimately, among minimally invasive therapies for BPH, TUMT has been studied more than the alternatives and has proven itself to be a reasonable option for patients seeking to avoid surgery or for whom pharmacotherapy has failed.<sup>5,11</sup>

## TRANSURETHRAL RADIOFREQUENCY NEEDLE ABLATION

Other minimally invasive therapies include needle ablation of the prostate using radiofrequency technology. A light anesthetic is employed for patient comfort and a catheter equipped with multiple needles is placed directly into the urethra. Segments of prostatic tissue are then heated via low frequency radio energy transmitted through the needles.

This technique results in a coagulation necrosis and subsequent tissue ablation at temperatures between 80 and 100°C.<sup>13</sup> Immediately following the procedure, swelling of the prostate is commonplace but a catheter can be placed to avoid retention. After a short time, the swelling rescinds and the prostate shrinks, alleviating the LUTS ascribed to the BPH. Unlike TUMT, patients undergoing TUNA frequently require a greater degree of anesthetic, whether that be pelvic block, spinal or light general anesthesia.<sup>6</sup> Improvement of LUTS for patients undergoing TUNA has been shown to remain stable over time with 53% improvement 3 months after treatment and 51% at 5 years.<sup>14,15</sup> TUNA requires less anesthetic and the odds ratio of experiencing a post-procedural adverse effect after needle ablative therapy is 0.14 (95% CI 0.05-0.41) compared to surgery.<sup>14</sup> Further review of comparative trials, though, suggests surgical intervention results in more profound improvement in patients' quality of life, maximum flow rate, postvoid residual volume and maximum flow detrusor pressure.<sup>14,16</sup> Incidence of re-treatment rate following TUNA has been inconsistent. A report by Bouza et al indicates a re-treatment rate of 19.1% and early data from the EAU database suggest a rate of 12%.<sup>15</sup> In 2007, Rosario and colleagues studied 71 men for whom medical therapy had failed and underwent TUNA while awaiting transurethral resection. Initial outcomes based on symptoms and uroflowmetry were promising after a year, but 83% of their population experienced failure of treatment after a mean of 20 months, as defined by worsening lower urinary tract symptoms requiring additional intervention or deteriorating quality of life and only twelve percent of patients remained symptom free without any additional therapy 10 years after ablative therapy.<sup>17</sup> In summary, TUNA has been demonstrated to produce improvement in quality of life and lower urinary tract symptoms, particularly in the short-term. While there is an increased risk of re-treatment compared to transurethral resection, TUNA offers a lower anesthetic burden and side effect profile compared to open surgery.

## WATER-INDUCED THERMOTHERAPY

Water-induced thermotherapy (WIT) is another heat-based therapy for symptomatic BPH whereby hot water is used to induce coagulation necrosis of the obstructing tissue. Treatment can be completed in 45 minutes and topical anesthetic has been shown to be sufficient for patient comfort. Few studies have evaluated this therapeutic option, but a 2003 multi-center, prospective, non-controlled study showed IPSS score and quality of life score improvements and re-treatment incidence similar to those seen following TUMT.<sup>18,19</sup> Predictive factors for successful outcome and contraindications have not yet clearly been established, as further evaluation of this technique, particularly in comparison to TURP, are warranted. At this time, the AUA and EAU consider WIT to be an investigational therapeutic option.<sup>5,6</sup>

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**The newer, minimally invasive therapeutic options have not yet been shown to outperform transurethral resection in terms of efficacy or retreatment requirements, but have provided the benefits of decreased anesthesia burden and fewer side effects...**

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## TRANSURETHRAL ETHANOL ABLATION

Transurethral ethanol ablation of the prostate (TEAP) relies on hemorrhagic coagulation necrosis as a mechanism of prostate tissue ablation. As ethanol is injected, arterioles and venules undergo thrombotic occlusion, thereby creating a necrotic environment which ultimately eliminates hyperplastic overgrowth. TEAP has been shown to be a viable technique

that can be performed safely with minimal anesthetic and that significantly improves maximum urinary flow rates, quality of life and IPSS scores.<sup>20</sup> Long-term durability has not been evaluated frequently. A 2004 report by Goya and colleagues demonstrated stable IPSS and urinary flow after three years, but 41% of their population ultimately required some form of re-intervention after 36 months.<sup>21</sup> Initial reports of TEAP reveal a promising outpatient based MIT, but further comparative studies, particularly with TURP, are required.

## CONCLUSION

Transurethral resection of the prostate has been considered the gold standard for treatment of BPH. Along with the introduction of new interventional techniques such as TUMT, TUNA and TEAP comes the optimism of effectively treating BPH while avoiding potential adverse outcomes and morbidities associated with invasive operations. The newer, minimally invasive therapeutic options have not yet been shown to outperform transurethral resection in terms of efficacy or retreatment requirements, but have provided the benefits of decreased anesthesia burden and fewer side effects amidst reasonable therapeutic outcomes.

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#### **Disclosure of Financial Interests**

The authors have no financial interests to disclose.

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# Minimally Invasive Stone Surgery: Percutaneous, Ureteroscopic and Extracorporeal Approaches To Renal and Ureteral Calculi

Michael Poch, MD, and George E. Haleblan, MD

**The goal of treating renal and ureteral calculi** is to achieve complete stone clearance with minimal morbidity. The treatment depends on various factors, including stone size, composition and location, clinical "patient factors", availability of the equipment and the surgeon's capability. Recent prospective trials suggest that ureteroscopy provides certain advantages over **shock wave therapy (SWL)** for the management of distal ureteral calculi.<sup>1</sup> Nevertheless, several surgical options are available for the treatment of proximal ureteral calculi and renal calculi. Recent advances in both technology and physiologic understanding have led to improvements in the management of urinary stone disease and allow for a variety of surgical options with decreased patient morbidity.

Calculus disease that requires surgical intervention is typically managed by three different modalities and is dependent on the factors stated above. Generally, ureteral calculi are managed either by SWL or **ureteroscopy with lithotripsy (URS)**. Renal stones are typically managed by the above two modalities as well as **percutaneous nephrolithotomy (PNL)**.

**Medical expulsive therapy (MET)** is defined as the use of pharmacologic means to facilitate passage of ureteral stones. These medications are typically alpha blockers with or without the addition of a steroid. This is an acceptable first line option for ureteral stones that are < 1 cm in size. This should be under close urologic supervision as rigorous imaging and evaluation of renal function are necessary to ensure that these patients do not develop renal insufficiency, obstruction, sepsis, or poorly controlled pain which would warrant urgent intervention.

## **SURGICAL TREATMENT OPTIONS** **SWL**

Shock wave lithotripsy was first introduced in the 1980s. The mechanism of stone fragmentation is focusing high intensity acoustic pulses generated extracorporeally on the target stone. The stone is targeted by fluoroscopy or ultrasound. The first shock

wave lithotripter (Dornier HM3) required patients to be submerged in a water bath under general anesthesia and it achieved excellent results. This device was difficult to use, costly and required significant resources to run. As a result it is no longer in use. Newer machines have eliminated the need for the water bath, no longer require general anesthesia and cost less. Again, stones are localized by fluoroscopic and/or ultrasound guidance. The patient's flank is positioned over a coupling device and acoustic shock waves are generated to lead to fragmentation of the targeted stone.

## **...with few exceptions, all staghorn calculi should be treated.**

New concepts in SWL have improved the compressive component of the shockwave by altering timing and pattern of the acoustic shockwaves. Additionally manipulation of the total energy delivered to the stone has been shown to enhance stone fragmentation while decreasing peripheral tissue damage. Efficacy of SWL can be predicted to a limited degree based on patient body habitus, skin-to-stone distance, the hounsfield unit measurement of the stone on CT scan, or stone composition (if known prior). Complications of SWL include steinstrasse, infection, renal hematoma and ureteral injury, all of which occur less than 5% of times.

## **Ureteroscopy with Lithotripsy**

Over the past 15 years, as ureterorenoscopes have become smaller with improved optics, the efficacy of the retrograde ureteroscopy for renal and ureteral calculi has improved. Rigid ureterorenoscopes typically range from 6-12 F and flexible scopes are range between 6-9 F. Ureteroscopy is performed with the patient under anesthesia in the lithotomy position. Use of fluoroscopy is neces-

sary for retrograde evaluation of the ureter and renal pelvis as well as to ensure proper positioning of safety wires and endoscopes. The ureteroscopes are advanced up the ureter in the retrograde fashion and lithotripsy is performed with a holmium/Yag laser. Overall perforation rates of less than 2 % have been described when using predominantly small-caliber ureteroscopes.<sup>2</sup> In a recent series of 1,000 ureteroscopic procedures no ureteral perforations occurred.<sup>3</sup>

When considering late postoperative complications, ureteral stricture is one of the most concerning. It may be a consequence of ureteral trauma from instrumentation or from calculus impaction. The rate of stricture formation has notably decreased with a decrease in size of the ureteroscope and improvements in ureteroscopic technique. Stricture rates of less than 1% using small-caliber semi rigid and flexible ureteroscopes have been reported whereas early reports using 9.5F to 12.5F ureteroscopes cited stricture rates of up to 4 %<sup>2</sup>.

## **PNL**

Fernstrom and Johansen in 1976 first described the technique of removing a kidney stone percutaneously.<sup>23</sup> Since then advances in technology, technical skill, and understanding of physiological principles have allowed percutaneous stone retrieval with increasing efficiency. Traditionally PNL is reserved for large renal calculi and specific instances for treatment of complex impacted large proximal ureteral calculi. Increasing evidence, however, suggests that the indications for PNL may be broadened to include treatment of smaller stones because of PNL's high stone-free rates with minimal complications.

Percutaneous access is gained with the patient in the prone position. The collecting system is typically opacified via a retrograde catheter with an occlusion balloon. With fluoroscopic or ultrasound image guidance placement of a needle percutaneously from the flank through renal parenchyma and into the collecting system is then performed. The percutaneous tract is then dilated to allow access into the kidney for stone removal. Tra-

**Table 1. Comparing clinical results of holmium laser ureteroscopy and SWL in the management of proximal ureteral stones**

	References		
	16 ; Lam et al.	15; Parker et al.	14; Wu et al
<b>Years of study</b>	1997-2001	1997-2001	2002-2003
<b>Number of procedures</b>	81	220	80
<b>Methods</b>	Retrospective	Retrospective	Prospective
<b>No. in SWL</b>	50	111	41
<b>No. in URS</b>	31	109	39
<b>Machine</b>	Dornier Doli 50	Dornier HM4 or Dornier Doli-S	Medispec
<b>Stone &lt; 10 mm</b>			All stone larger than 10 mm; mean stone size SWL = 12.8 mm, URS 15.1 mm
<b>Successful SWL;</b>	80%	60%	
<b>Successful URS;</b>	100%	90%	
<b>P value</b>	-	<0.0001	
<b>Stone ≥ 10 mm</b>			
<b>Successful SWL;</b>	50%	45%	
<b>Successful URS;</b>	93%	93%	
<b>P value</b>	-	<0.0001	
<b>Overall stone free rate</b>			
<b>SWL</b>		55%	61
<b>URS</b>	-	91%	92
<b>P value</b>		<0.001	0.003
<b>Complications SWL(n)</b>	<b>Minor;</b> Renal colic, none required hospital admission	<b>Overall;</b> 33.5%, <b>Major;</b> 1.8% (1 urosepsis, 1 pyelonephritis)	Flank soreness (more common in SWL group) and gross hematuria; none required admission
<b>Major/Minor</b>			
<b>Complications URS(n)</b>	None	<b>Overall;</b> 28.4%, <b>Major;</b> 6.4% (1 perforation, 1 urosepsis, 1 pyelonephritis, 2 cardiac complications, 2 ureteral stricture)	
<b>Major/Minor</b>			

ditionally, postoperatively patients are left with a temporary nephrostomy tube which aids in drainage of the renal unit and also allows for tamponade of the renal parenchyma. Nephrostomy tubes are generally removed before patients are discharged from the hospital. Absolute contraindications to PNL include bleeding diathesis and acute infection. Complications include bleeding injury to adjacent organs including lung, colon, spleen and liver.

Stone-free rates for PNL depend on preoperative stone burden and imaging modality to determine efficacy. In recent studies stone-free rates for all renal calculi averaged 87% - 100%.<sup>4,5</sup>

Advances in PNL include both "tubeless" PNL, "tubeless, stentless PNL, and bilateral synchronous PNL. With increasing efficacy of PNL new attempts at decreasing patient morbidity and discomfort have led surgeons to perform PNL without nephrostomy tubes. During these cases an internal antegrade double J stent is placed and the patients are left without nephrostomy tubes. Recent PNL studies comparing tubeless PNL to traditional PNL with nephrostomy tube have shown a significant decrease in post operative analgesic requirements, hospital stay, and operative

time with equivalent stone free rates for those patients undergoing tubeless PNL.<sup>6-8</sup> In addition, in specific situations with uncomplicated stones, patients are left without both a nephrostomy tube and an internal stent, thereby obviating a secondary procedure to remove the stent. Preliminary outcomes from this procedure are encouraging.<sup>9,10</sup>

Patients with large bilateral stone burdens have traditionally been treated with staged procedures, addressing each renal unit at different anesthetic. Recent studies have shown not only the safety but the efficacy of performing bilateral synchronous PNL, decreasing overall cost and patient anesthesia requirements.<sup>11</sup>

## SPECIFIC CONSIDERATIONS

### Staghorn Calculi

Staghorn calculi are branched stones, commonly composed of magnesium ammonium phosphate (struvite), that occupy a large portion of the collecting system. These stones are frequently denoted "infection" stones because of their association with urease-producing bacteria which cause urinary tract infections.

In 2005 the American Urological Association (AUA) developed guidelines for the treatment of staghorn calculi. Left un-

treated, staghorn calculi pose significant risk for kidney loss, sepsis and death. As a result with few exceptions, all staghorn calculi should be treated.<sup>12</sup> PNL is the preferred method of treatment of staghorn calculi, which has shown to have stone free rates up to 3 times higher compared to those of SWL monotherapy with the mean number of procedures to become stone free as 1.9 for PNL compared to 3.6 for SWL. In addition, open surgery should not be used for the majority of patients.

## Lower Pole Stones

Two randomized trials evaluated the efficacy of SWL, ureteroscopy, and PNL for lower pole stones based upon stone size.<sup>13,14</sup> For lower pole stones < 1.0 cm in size patients were randomized to SWL and URS, patients were followed post operatively with CT scans. Surprisingly the authors found an overall stone free rate was 50% or less for either treatment modality. In addition there was no statistically significant difference in stone free rates between SWL and URS (35% compared to 50%). Therefore SWL and URS are both viable treatment modalities for lower pole stones < 1.0 cm. More recently data presented by Patel et. al. demonstrate that for lower pole stones less than <15 mm treated by tubeless PNL stone free rates were 100% compared to a similar cohort treated by URS (80%) and SWL (30%).<sup>22</sup>

For stones > 1.0 cm PNL achieved stone free rates 95% while SWL achieved stone-free rates of only 37%. Hospital stays were on average 2 days longer 2.66 to 0.55 for PNL compared to SWL, and complication rates were not significantly different between the two groups. Therefore it appears for stones > 10 mm PNL would be the modality of choice to achieve the best stone-free rates.

## Ureteral Calculi

In 2007 the AUA published a meta-analysis and guidelines for the management of ureteral calculi.<sup>15</sup> For stones within the ureter managed by SWL stone free rates depend on locations. Stone free rates are as high as are 82%, 73%, and 74% for the proximal, middle, and distal ureter respectively. Advances in optics and laser technology over the past ten years have improved efficacy of ureteroscopy. Currently ureteroscopic stone-free rates are 87%, 86%, and 96% for proximal, middle and distal ureter respectively. Based on the above data the analysis revealed that overall stone free

rates for calculi in the proximal ureter were roughly equivalent for SWL and URS. However on subgroup analysis SWL had superior stone free rates for proximal ureteral calculi <10 mm. In contrast, stones > 10mm in the proximal ureter were better managed by URS.<sup>16-18</sup> (Table 1) Distal and mid ureteral calculi were best managed by URS.

## Pediatrics

For pediatric patients with ureteral stones both SWL and URS appear viable options. Children are able to pass stone fragments after SWL more easily than adults. Ureteroscopy can be used as a primary or secondary treatment modality followed by SWL but is often limited to the size of ureteroscope and the diameter of the patients ureter. For pediatric patients with larger staghorn calculi, SWL appears to be more effective than in adults and stone free rates can reach up to 80%.<sup>19</sup> Additionally PNL appears to be an efficacious treatment for staghorn calculi in children as well.

## Pregnancy

Calculus disease in the pregnant population can pose a risk to the fetus for both diagnosis and treatment. For a pregnant patient with stones in whom conservative management fails, traditional treatment with either PCN or ureteral stenting is suggested, with definitive treatment deferred until the postpartum period. However, placement of either a stent or PCN tube is not without morbidity. While pregnancy is a contraindication for SWL, recent studies have revealed the safety and efficacy of ureteroscopy for the pregnant patient.<sup>20, 21</sup>

Watterson and colleagues<sup>15</sup> reported a series of ureteroscopy with lithotripsy in pregnancy. They used the ureteroscopic laser treatment in 8 patients with 10 symptomatic ureteral stones in whom conservative treatment failed. There were 3 cases with stones in the upper ureter; one of them had an encrusted stent. The overall stone-free rate in this series was 89%. Two of the proximal ureteral stones were treated successfully. In one patient who presented an encrusted stent at 35 weeks of gestation, the stent was removed successfully and definitive stone treatment was deferred until the postpartum period. There were no obstetric or urologic complications.

## CONCLUSIONS

We have presented clinical data, including technical considerations and complications, for PNL, URS and SWL treat-

ment modalities. The AUA has set guidelines for treatment of urinary calculi. In many situations, however, there are multiple treatment options. ALL of these options are standard of care in Rhode Island. According to the 2007 AUA Ureteral Stone Clinical Guidelines, SWL or URS are recommended first line treatment options for ureteral stones. SWL has been less successful in treatment of larger calculi and often requires multiple treatments. With the development of small flexible ureteroscopes and holmium laser technology, treatment of larger and more complicated ureteral and renal stones can be effectively and safely performed ureteroscopically, even in high risk patients, in a single setting and should be considered the treatment of choice for these situations. Guidelines for treatment of renal stones are less clear because AUA guidelines have been developed for staghorn renal calculi only. For small renal stones < 2cm, SWL and URS are acceptable first line therapies; however, consideration of stone location and renal anatomy may impact the choice of therapy with increasing evidence suggesting that PNL may be acceptable for treatment of smaller lower pole renal stones with minimal patient morbidity and excellent stone free rates. PNL should be considered the first line therapy for patients with large renal calculi or staghorn renal calculi. With surgeons experienced in these techniques, patient morbidity and complication rates are low while outcomes are excellent.

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The authors have no financial interests to disclose.

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# Images In Medicine

## Ureteroscopic Management of Renal Calculi In a Pelvic Kidney

*Sutchin R. Patel MD, and George E. Haleblan MD*

**A fifty-four year old man presented to the emergency room** with lower abdominal pain and the inability to urinate. He denied any fevers, nausea or vomiting and his physical exam was significant for suprapubic tenderness, a palpable bladder, no costovertebral angle tenderness and a mass palpated at the penile urethra. Non-contrast computed tomography revealed a right pelvic kidney with three 1 cm renal stones and a single 0.5cm obstructing mid urethral stone with a distended bladder. The patient passed his urethral stone soon after returning from radiology and voided spontaneously thereafter. His three remaining nonobstructing renal calculi were treated surgically as an outpatient.

According to autopsy series, the incidence of renal ectopia ranges from 1 in 500 to 1 in 1200 patients. The incidence of stones in patients with pelvic kidneys is known to be higher than the general population. The ectopic position and altered anatomy can often present a challenge to urologists managing patients with symptomatic nephrolithiasis.

**Percutaneous nephrolithotomy (PCNL)** has been the mainstay of treatment for high stone burden nephrolithiasis with the highest success rate rendering the patient stone free. However, given the altered anatomy in a pelvic kidney, one would have to consider a laparoscopic approach in order to perform a PCNL or to consider ureteroscopy. In this case we opted to perform ureteroscopy. Despite the significant stone burden in his pelvic kidney the shorter ureter made ureteroscopy much less challenging. Flexible ureteroscopy with laser lithotripsy and stone extraction successfully rendered the patient stone free.

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## A Pause for Reflection and Acknowledgement

*Ana Tuya Fulton, MD*

The column first ran in January of 2007. From the vantage of July 2009, the editor, authors and sponsors would like to reflect on the past, acknowledge the present and speculate about the future. We envisioned the column as a vehicle to share resources and knowledge to help all practitioners care for the often complicated and challenging older adult population. The format developed as a case-based discussion on clinically relevant topic areas in geriatrics care, accompanied by a variety of scholarly resources and web-based tools. Topics varied, ranging from basic geriatric assessment and management to disease-specific discussions (Table).

Column authorship varied as much, including pieces written by senior academic geriatricians, junior faculty, geriatrics fellows in training, residents, nurse practitioners and other health professionals. The unifying theme has always been a strong desire to improve the awareness of geriatrics issues and to provide all practitioners with knowledge and tools they need to care for older persons. The expanding senior population has become too large for the fewer than 10,000 geriatricians to provide much of the primary care for older adults. Accordingly, most providers share both in the responsibility of providing their care and acquiring basic competencies for this care of older persons. This perspective remains the underlying goal and premise for the column. We hope the column's tools and knowledge are useful, and that it piques your curiosity to learn more about the nuances of care for the older patient.

Now, after 25 monthly columns and one entire issue devoted to patients in nursing homes, the time has come to reassess your needs. Please contact the editor with your recommendations for topics, areas of interest, criticisms and format changes, or just to offer feedback. In addition, a formal needs assessment survey accompanies this column; please help us by completing this five-minute survey. We welcome your submission; contact the editor to inquire about your area of interest or the experiences you might like to share.

Most importantly, we would like to thank all of our supporters. You, for your readership and the feedback you have already given. Thanks also to all of our contributors, who have submitted articles, and those who have taken the time

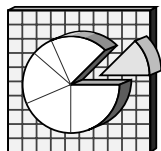
to edit and review. Finally, the Centers for Medicare & Medicaid Services (CMS) whose support through Quality Partners of Rhode Island (QPRI), the Medicare quality improvement organization for Rhode Island, have provided the funding permitting monthly publication of the column. These articles have fostered better, safer and timelier care of our older adults, along the themes of the prior 8<sup>th</sup> and current 9<sup>th</sup> scope of work QPRI does under contract with CMS. We take pride in this partnership toward bringing better care to Rhode Island's elders.

**Table 1. RI Medicine & Health Geriatrics for the Practicing Physician Publications**

Publication Date	Topic
January 2007	Comprehensive Geriatric Assessment
February 2007	Medication Management
March 2007	Falls
April 2007	Transitions of Care
May 2007	Palliative Care & Hospice in Nursing Homes
June 2007	Insomnia
July 2007	Nursing home edition <ul style="list-style-type: none"> <li>- Culture Change</li> <li>- Medical Director Role</li> <li>- Transitions of Care</li> <li>- Infections</li> <li>- "Big hitter" issues</li> </ul>
August 2007	Elder Abuse
September 2007	Chronic Dizziness
October 2007	Osteoporosis and Vitamin D deficiency
December 2007	Hypoactive Delirium
January 2008	Use of PEG tubes in Alzheimer's
February 2008	Nutrition and Failure to Thrive
March 2008	Home Visits
April 2008	Hospice Referral Indications
June 2008	Clinical Case Series
August 2008	Reynolds Grant Progress Article
September 2008	Hospital Transitions of Care
October 2008	Sex in the Older Adult
November 2008	Determination of Prognosis
December 2008	Pressure Ulcer Diagnosis, Staging, Risks
January 2009	Pressure Ulcer Treatment
February 2009	Cancer Screening
March 2009	Caregiver Stress
April 2009	Anticoagulation and Atrial Fibrillation
May 2009	Dementia & Behavioral Disturbances
June 2009	Depression in the Older Adult
July 2009	Hip Fracture Management

[http://www.surveymonkey.com/s.aspx?sm=C3dkxcK739KPF\\_2fqgWEk2eg\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=C3dkxcK739KPF_2fqgWEk2eg_3d_3d)

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## Seasonal Influenza Vaccination Coverage Among Pregnant Women In Rhode Island

*Hyun (Hanna) Kim, PhD, Patricia Raymond, RN, MPH, Virginia Paine, RN, MPH, Rachel Cain, and Samara Viner-Brown, MS*

**Pregnant women have increased morbidity and mortality from influenza infection**, due to the physiologic changes associated with pregnancy.<sup>1</sup> The **Advisory Committee on Immunization Practices (ACIP)** recommends influenza vaccination for all women who are pregnant or will be pregnant during influenza season, with **trivalent inactivated influenza vaccine (TIV)**.<sup>2</sup> TIV has been considered safe and effective during any stage of pregnancy.<sup>2</sup> In addition, a recent study conducted in Bangladesh demonstrated that influenza vaccination during pregnancy had a significant effect in reduction of influenza illness among their infants up to 6 months of age.<sup>3</sup> The **American College of Obstetricians and Gynecologists (ACOG)** and the **American Academy of Family Physicians (AAFP)** also recommend routine vaccination of all pregnant women. Despite these recommendations, the National Health Interview Survey showed that only 24% of pregnant women received influenza vaccine during the 2007-2008 influenza season.<sup>2</sup>

This report describes the trends of influenza vaccination coverage among pregnant women in Rhode Island, characteristics related to influenza vaccination during pregnancy, and reasons for not being vaccinated.

### METHODS

Data from the 2002-2007 Rhode Island **Pregnancy Risk Assessment Monitoring System (PRAMS)** were analyzed to assess influenza vaccination coverage rates among pregnant women. PRAMS, a surveillance project of the **Centers for Disease Control and Prevention (CDC)** and state health departments, collects state-specific, population-based data on maternal behaviors and experiences before, during, and shortly after

delivery of a live infant.<sup>4</sup> Rhode Island has collected PRAMS data since 2002; each year, about 1,400 Rhode Island recent mothers respond to the survey.

Rhode Island included three influenza immunization questions in the PRAMS survey: 1) "Did you get a flu vaccination during your most recent pregnancy?" (Data have been collected since 2002); 2) If not "What were your reasons for not getting a flu shot during your most recent pregnancy?" (Data were collected only for 2002 and 2003); and 3) "At any time during your most recent pregnancy, did a doctor, nurse, or other health care worker offer you a flu vaccination or tell you to get one?" (Data have been collected since 2004). PRAMS data were weighted to represent all Rhode Island women who have delivered a live infant each year, and were analyzed to estimate influenza vaccination coverage, 95% confidence intervals, and chi-square *p*-values. SUDAAN software was used for data analyses, which takes into account the complex sample design of the survey. Response rates for the years of data examined were 70% or higher.

### RESULTS

The percentage of women who received influenza vaccine during their pregnancy increased significantly from 18.2% in 2002 to 33.4% in 2007 ( $p < 0.0001$ ). Although vaccination coverage rates increased consistently during the period, a substantial increase was observed from 2004 to 2005 (8.1 percentage points or 37% increase;  $p < 0.0001$ ), and a marginal increase was observed from 2006 to 2007 (3.0 percentage points or 10% increase;  $p = 0.1674$ ). The percentage of women who reported that their health care providers recommended

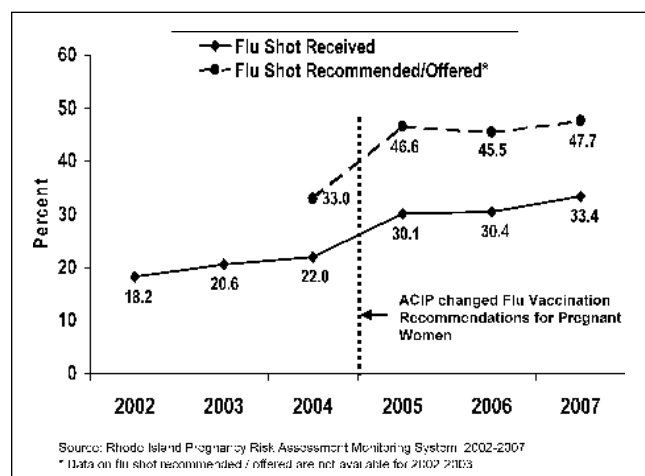


Figure 1. Percentage of women who received influenza vaccine during pregnancy and percentage of women who were recommended/offered influenza vaccine, Rhode Island, 2002-2007

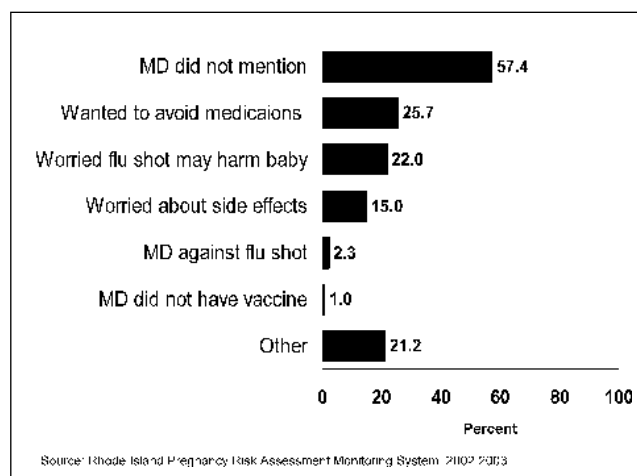


Figure 2. Reasons for not getting influenza vaccination during pregnancy, Rhode Island, 2002-2003

Table 1. Influenza vaccination coverage rates among women with a recent live-birth by selected characteristics, Rhode Island, 2005-2007 (n = 4,156)

	%	95% CI	P-Value
<b>Overall</b>	31.3	(29.6 33.0)	
<b>Maternal Age (in year)</b>			
< 20	29.5	(24.2 – 35.5)	0.1265
20-29	30.0	(27.6 32.6)	
≥ 30	33.0	(30.5 – 35.6)	
<b>Maternal Ethnicity</b>			
Hispanic	37.5	(33.8 – 41.3)	0.0005
Non-Hispanic	29.7	(27.7 31.9)	
<b>Maternal Race</b>			
White	31.2	(29.4 33.1)	0.9765
Black	31.2	(26.0 – 36.9)	
Other†	32.0	(25.7 39.0)	
<b>Maternal Education</b>			
< High School	32.3	(28.1 – 36.8)	0.0003
High School	26.1	(23.2 29.3)	
> High School	34.0	(31.7 – 36.4)	
<b>Household Income</b>			
< \$10K	32.7	(28.6 – 37.0)	0.0001
\$10K - <\$25K	28.8	(25.1 32.7)	
\$25K - <\$50K	24.0	(20.5 – 27.9)	
≥ \$50K	34.7	(32.0 37.6)	
<b>Marital Status</b>			
Married	33.7	(31.5 – 35.9)	0.0007
Not married	27.7	(25.2 – 30.4)	
<b>Insurance for Prenatal Care</b>			
Public	29.2	(26.6 31.9)	0.1145
Private	32.0	(29.8 – 34.4)	
<b>Prenatal Care Initiation</b>			
1 <sup>st</sup> Trimester	31.7	(29.9 – 33.6)	0.0979
> 1 <sup>st</sup> Trimester	27.8	(23.8 32.2)	
<b>Pregnancy Intendedness</b>			
Intended	33.1	(31.0 35.4)	0.0075
Unintended	28.4	(25.7 – 31.2)	
<b>WIC Participation</b>			
Yes	31.3	(28.8 – 33.9)	0.9553
No	31.4	(29.1 – 33.7)	
<b>Flu Vaccine Recommended/ Offered</b>			
Recommended/Offered	62.9	(60.2 – 65.5)	<0.0001
Not Recommended/Offered	4.1	( 3.2 5.2)	

Data Source: Rhode Island Pregnancy Risk Assessment Monitoring System, 2005-2007

Other category includes American Indian/Native American, Asian/Pacific Islander, and other.

or offered influenza vaccine during pregnancy also significantly increased from 33.0% in 2004 to 47.7% in 2007 ( $p < 0.0001$ ). A similar substantial increase in the recommendations/offers was observed from 2004 to 2005 (13.6 percentage points or 41% increase;  $p < 0.0001$ ), but there was no significant increase during 2005-2007. (Figure 1)

In the 2002-2003 PRAMS survey, pregnant women who did not get vaccinated were asked to give the reasons (multiple reasons were allowed). The reasons included: My doctor did not mention anything about a flu shot during my pregnancy (57.4%); I wanted to avoid medications during my pregnancy (25.7%); I was worried that the flu shot might harm my baby (22.0%); I was worried about side effects of the flu shot for me (15.0%); My doctor recommended against getting a flu shot (2.3%); My doctor did not have the vaccine (1.0%). Other reasons included: I don't normally get the flu shot; I was in the first trimester of pregnancy during the flu season; I was not pregnant during the flu season. (Figure 2)

Influenza vaccination coverage during pregnancy was significantly higher among Hispanic women (37.5%), women with > high school education (34.0%), women who had annual household incomes ≥ \$50,000 (34.7%), married women (33.7%), and women with intended pregnancy (33.1%) than for their counterparts. Women who were recommended or offered influenza vaccine by their health care providers were 15 times more likely to be vaccinated than women who were not recommended or offered the vaccine (62.9% vs. 4.1%). (Table 1)

## DISCUSSION

Although the influenza vaccination coverage among pregnant women increased significantly from 2002 to 2007, the rate is still alarmingly low. Only one third of Rhode Island women received influenza vaccine during their pregnancy in 2007.

Among other characteristics, influenza vaccination was strongly associated with health care provider recommendations/offers: when health care providers recommended or offered influenza vaccine, pregnant women were much more likely to get vaccinated. Of considerable concern, in 2007, less than one half of Rhode Island women (47.7%) reported that their health care provider recommended or offered influenza vaccination during their pregnancy. Consistently, in 2002-2003, the reported major reason for not getting vaccinated was that their doctor did not mention anything about influenza vaccination during their pregnancy.

A substantial increase in influenza vaccination coverage and recommendations/offers for vaccination observed from 2004 to 2005 could be, in part, related to changes in ACIP recommendations in May 2004, stating that due to the increased risk for influenza-related complications, pregnant women could be vaccinated during all trimesters of pregnancy. Prior to this change, influenza vaccination was recommended only for women who would be in their second or third trimester of pregnancy during flu season.

This study has some limitations: 1) PRAMS data are self-reported by women 2-6 months postpartum and therefore their reporting on influenza vaccination and provider recommendations may be subject to recall bias, and 2) data on reasons for not getting an influenza vaccination were collected only for 2002 and 2003, which were prior to changes in ACIP recommendations for pregnant women.

The findings of this study indicate that health care providers play a critical role in the acceptance of influenza vaccine by pregnant women. To improve influenza vaccination coverage among pregnant, health care providers should use the first prenatal care encounter to educate women about the risk of influenza complications during pregnancy and the protective effect of influenza vaccination on women and their infants, and providers should offer vaccination at the earliest opportunity during influenza season.

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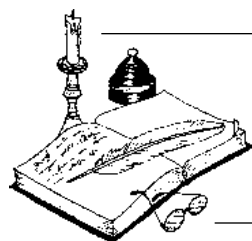
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The authors have no financial interests to disclose.

**Note:** This work was originally presented at the 43rd National Immunization Conference, Dallas, TX; March 30, 2009. Abstract at <http://cdc.confex.com/cdc/nic2009/webprogram/Paper18186.html>.

The CDC published a related article in partnership with the Rhode Island Department of Health: "Receipt of Influenza Vaccine During Pregnancy Among Women With Live Births - Georgia and Rhode Island, 2004-2007"; *MMWR* 2009;58; 972-5. Abstract at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5835a2.htm>



# Physician's Lexicon

## Words Foretelling the Future

Long before the profession of medicine discovered effective interventions to allay the symptoms of human ailment, it assumed the heavy, and often hazardous, burden of foretelling the medical futures of patients, more an act of blind courage than clinical insight. The vocabulary of medical prediction, of prognosis, is therefore rich in synonyms variously derived from Latin, Greek and Old German.

The augurs were a collegium of priests in ancient Rome assigned the duty of foretelling and interpreting the future. They observed the flights of birds (their direction, species, numbers) and then translated the gathered data to prophesy the future – whether it be the outcome of a war just beginning, the felicity of an imminent marriage or the early phases of an illness in a patient. Augury, then, becomes the art of revealing the future by the trained interpretation of natural signs, such as the flight of birds or even the configuration of tea-leaves upon the inner surface of a cup. The word inaugurate originally meant to divine

the future and thus to consecrate or to install its reality. It has now come to mean to begin formally. Augur, in turn, was probably descended from an older Latin word, *augos*, meaning to increase (as in the English word, augment) and belatedly gave rise to words such as august, meaning to increase in majesty, to make venerable.

Omen comes from a Greek word meaning to think or to discern the details of the future. It is the root of the English words ominous and abominable.

The word, prognosis is from the Greek, *gnosis*, meaning knowledge and the prefix *prae-* meaning before.

Prophecy is from the Latin, and earlier from the Greek, *propheta*, meaning one who speaks for the gods; and the verb, to predict, stems from the Latin *prae-* meaning before and *dicere*, to speak. To portend is also from the Latin, *portendere*, meaning an omen; and is based earlier on *tendere*, meaning to stretch or to move in a certain direction. A portent is therefore an omen, usually foreboding, giving rise to the

English word, portentous, equivalent in meaning to ominous or menacing. Presage is similarly of Latin derivation and is based on the root, *sagire*, meaning to perceive [see the English word, sagacity.] Revelation is from the Latin, *revelationum*, meaning to uncover, to reveal. And apocalypse, is derived from the Greek, literally meaning away from the covering, an uncovering or a revelation. When capitalized, it is a synonym for the Scriptural Revelation of St. John the Divine.

Soothsaying descends from the Old High German word, *soth*, meaning truth or reality. And thus a soothsayer is one who reveals, often for a fee, the unembellished, truthful future. For obvious reasons, most soothsayers, sometimes called mountebanks (from Italian, *montimbanco*, to mount a bench) or charlatans (from Italian, *ciarlare*, to prattle), were often itinerant hucksters (from the Dutch, *hokester*, meaning to bear on one's back), leaving town before the future became the present.

– STANLEY M. ARONSON, MD

# THE RHODE ISLAND MEDICAL JOURNAL

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## FIFTY YEARS AGO, OCTOBER 1959

In the 8<sup>th</sup> Annual Arthur Hiler Ruggles Oration, "New Knowledge for Better Mental Health," Jack R. Ewalt, MD, Professor of Psychiatry, Harvard Medical School, reported on a national survey conducted by the Joint Commission on Mental Illness and Mental Health. "We wished to find out what people did when they become unhappy, worried, mentally ill or otherwise troubled..." Surveyors asked a sample of people where they sought help: "... people who seek help for personal problems tend to have a psychological orientation to life....they are introspective and self-questioning." The major national crises (threat of atomic fallout, high taxes, housing shortage) "that are reportedly causing our society great tension and stress, appeared as an important source of worry in a very small number of people. People seem to derive their satisfactions from rather mundane things...their families,...children... community activities."

Jose M. Ramos, MD, Director of the Arthritis Clinic, Newport Hospital, contributed "The Value of Infiltrations in Cases of Subacromial Bursitis Due to supraspinatus Tear." "Too frequently the physician gives the shoulder a casual survey and resorts to the time-honored diagnosis of 'bursitis' without actually determining the real cause of pain." Reviewing the records of 36 patients with acute subacromial bursitis due to supraspinatus tear, Dr. Ramos found that "...the primary consideration should be given to the acute bruise section. The treatment of the tendon should be secondary and follow at an interval of 4 to 5 days."

Stuart Willis, MD, from the North Carolina Tuberculosis Sanatorium System, delivered "The Case for Forcible Hospitalization of the Recalcitrant Tuberculous Patient" at the 52<sup>nd</sup> annual meeting of the RI Tuberculosis and Health Association. In North Carolina's system of 4 hospitals, staff assumed that the AWOL patient ("After Women or Liquor") "has problems at home or is fed up with hospital life." Staff urge the patients to return, but eventually a recalcitrant patient can be arrested, sentenced to the prison domain of the state Sanitarium.

At that same meeting, Sidney H Dressler, MD, Medical Director, National Jewish Hospital, Denver, presented: "The Case Against Compulsory Isolation of the Recalcitrant Tuberculosis." Dr. Dressler called it "unnecessary as well as a misapplication of police authority in the hands of those whose training and backgrounds should make them regard this as repugnant." He estimated that 1 to 3% of patients were recalcitrant.

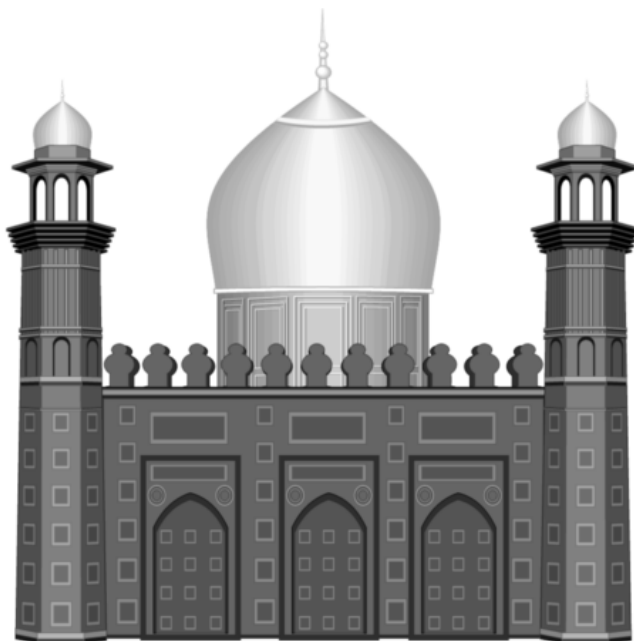
Edwin Dunlop, MD, Assistant Medical Director, Fuller Memorial Sanitarium, contributed "Depression: Treatment of Office Patients with Phenleazine [Nardil]." He reported on 50 patients: 82% had complete recovery from their depression; their side reactions were controlled by adjusting the dosage.

## TWENTY-FIVE YEARS AGO, OCTOBER 1984

Touissaint A. Leclercq, MD, FACS, FICS, Robert E. Knisley, MD, Richard P D'Amico, MD, and Joseph Di Benedetto Jr, MD, in "Evaluation of Transsphenoidal Hypophysectomy in the Management of Metastatic Breast Carcinoma," reviewed the literature and discussed their experience with 30 cases. "The most favorable candidates have a history of previous response to hormonal manipulation."

Christopher Ehmann, MD, Dennis B. Kruss, MD, and Charles B. Kahn, MD, in "Pituitary Hyperthyroidism: Report of 3 Cases," noted: "This unusual clustering...probably represents a heightened awareness and the availability of TSH assay."

Kemi Nakabayashi, Sarah C. Aronson, Michael Siegel, William Q. Sturner, MD, and Stanley M. Aronson, MD, reported on "Traffic Fatalities in RI, Part III: The Role of the Motorcycle." They reviewed data on 109 motorcycle fatalities, concluded: "More data are needed to evaluate the impact of alcohol and helmets."





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