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Robotic vs. open retropubic prostatectomy: A history of prostate cancer

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Throughout the course of history, urine has been valued for the wealth of information it provides regarding the well-being of a person or community. The ease of urinary output has been an indicator of good health, or conversely, illness. The value of unobstructed urinary flow and the presence of fluids has been well documented. For example, in ancient villages in Africa, the release of rain by the clouds symbolized urinary output of the gods and was viewed by the villagers as a sign of protection from evil offered by the gods.[1] In the 17th century, urine was used by many French women as a beauty product to soften skin and freshen breath. Urine was also promoted as a treatment for warts and a cure for baldness.[1]

With such a high importance placed on urine, an obstruction in urinary output required immediate intervention; catheterization was used to relieve urinary retention. The presence of the catheter is visible throughout history. Nahon and colleagues noted that for a period of time spanning 2,000 years, urinary obstructions were relieved with catheters made of a variety of materials, including hollow leaves, metal, glass, rubber, and gum elastic compounds.[1] The catheter led to the development of additional devices that could be used in the urethra to relieve an obstruction and visualize structures. For example, the development of the direct light endoscope in the final decade of the 19th century enabled physicians to directly visualize the structures of the urethra and bladder and diagnose the cause of the obstruction with greater accuracy and precision.[1] It also allowed for more focused treatments and interventions.

The prostate and prostatectomy

The first documented prostatectomy was performed using a perineal approach in 1860 by Dr. Theodor Billroth.[2] A systematic technique for the removal of the prostate did not exist at this time. The first radical perineal prostatectomy marks the inception of the systematic approach to prostate removal. In 1904, the first documented radical perineal prostatectomy was performed at Johns Hopkins by the American surgeon, Dr. Hugh Hampton Young.[3] Dr. Young implemented and described a systematic approach based on the actual anatomy of the patient. This systematic approach was the gold standard method for prostatectomy for the next 4 decades until 1930.

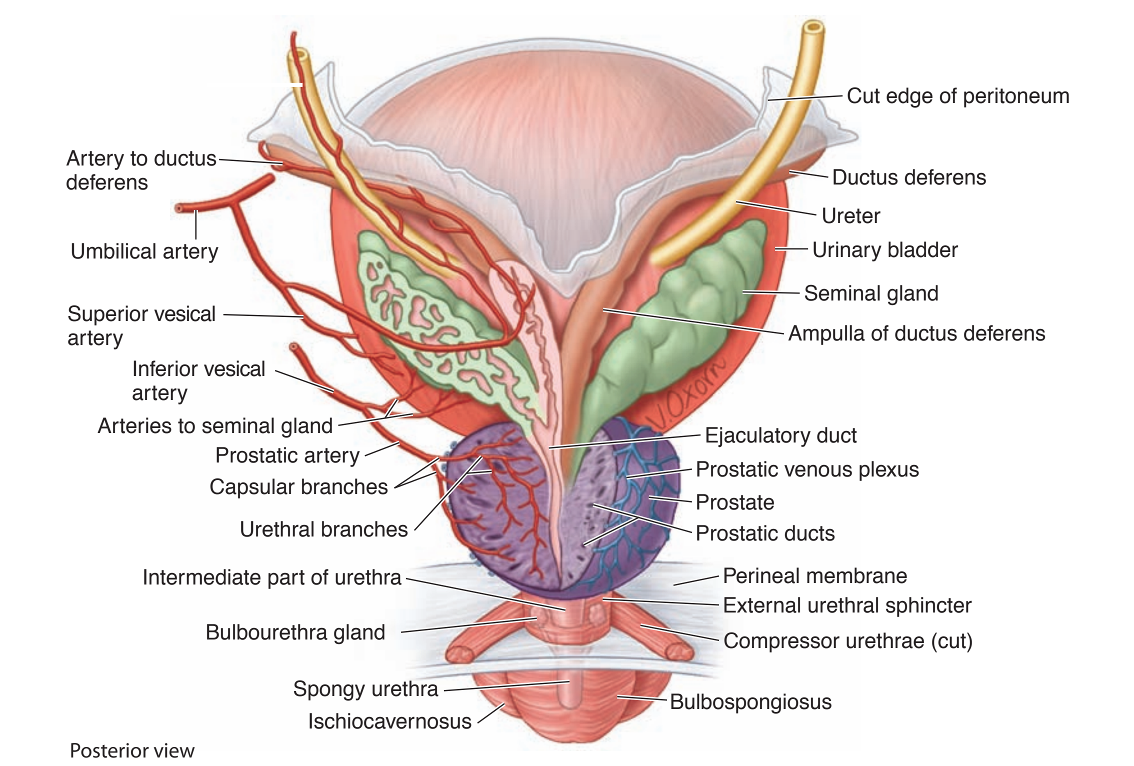
In 1930, the prostate was removed via the urethra using a method called transurethral resection of the prostate. As the medical and surgical community gained a greater understanding of the vascular and anatomical components of the prostate and its surrounding structures, advancements in surgical approaches continued to develop. In 1945, the first retropubic prostatectomy, which removes the prostate through an incision in the lower abdomen, was

performed by Dr. Terence Millin in London.[2] Although advances in technique and dialogue continued related to the anatomy, it was not until the early 1980s that a complete description of the anatomy of the prostate was detailed in writing. This contribution has proved fundamental in increasing the overall understanding of the prostate's function and its role in urinary obstruction.

In 1983, Dr. Patrick Walsh, an American surgeon, provided a detailed description of the anatomy of the prostate.[4] In it, Dr. Walsh described the accompanying structures of the prostate, including the dorsal venous complex and the neuro-vascular bundles, which are responsible for erectile function.[2] Prior to the anatomical detail of the prostate provided by Dr. Walsh, nearly all patients undergoing a prostatectomy were left impotent as a result of the procedure.[3] In light of the anatomical descriptions made by Dr. Walsh, prostatectomy techniques continued to advance, resulting in better outcomes.[4] Advances in surgical techniques, anatomical understanding of the prostate, and advances in anesthesia have led to greater improvements in prostatectomy.

In 1989, after experimenting with a potato, four researchers (Davies, Hibberd, Coptcoat, and Wickham) suggested that by using a robot, the prostatectomy could be performed in less time than when performed by a single surgeon. After this postulation, the laparoscopic and robotic approach to the prostatectomy spread worldwide.[1] The asserted benefits of the robotic-assisted prostatectomy included fewer surgeons needed for the surgery, greater precision and accuracy, a smaller incision, and fewer complications.[1] The first fully robotic-assisted laparoscopic radical prostatectomy was performed in 2000.[5] The availability of this new technology and the proposed benefits led to a dramatic increase in the number of robotic-assisted procedures in the United States. The rate of robotic-assisted

Anatomy of the prostate gland and surrounding structures



Source: Moore KL, Dalley AF, Agur AM. *Clinically Oriented Anatomy*. 6th ed. Philadelphia, PA: Wolters Kluwer/Lippincott Williams & Wilkins; 2010:379.

prostatectomies increased from 10% in 2006 to 65% between 2008 and 2009.[1]

Currently, the prostate may be removed using a variety of different approaches, including retropubic, perineal, laparoscopic, and robotic approaches. The approach used is often based on the surgeon's skill set/ preference, patient preference, and/or the appropriateness of the procedure in alleviating the specific obstruction. Patient comorbidities, such as obesity, may factor into the approach selected. Little evidence exists to document the superiority of one technique over the other in the prostate removal.[2]

Modern surgical approaches to remove the prostate include the perineal, open retropubic, laparoscopic, and robotic approaches.

Prostate function. The prostate is a small, circular gland that sits at the base of the bladder surrounding the urethra.[6] (See *Anatomy of the prostate gland and surrounding* structures.) The normal prostate gland has been compared and described as the size of an English walnut.[7] The primary function of the prostate is to produce fluid to protect sperm and facilitate their motility. Further, the prostate fluid protects the sperm in the semen from the acidic environment of the female reproductive system to allow for fertilization of an ovum.[8]

The prostate gland is comprised of three different, distinct zones: the transition zone, the central zone, and the peripheral zone.[8,9] The transition zone is anterior and lateral to the proximal urethra superior to the verumontanum (where the seminal vesicles enter the urethra) and harbors 25% of cancers that occur in the prostate.[10] The central zone is located above and just behind the proximal urethra and surrounds the ejaculatory ducts.[10] The peripheral zone is the largest of these zones, comprising approximately 70% of the prostate's glandular elements. It is also where 70% of prostate cancer occurs.[8,10]

Prostate cancer

Prior to the 20th century, removal of the prostate was performed to alleviate symptoms caused by urinary obstruction. It was not until the 20th century that the prostate was removed because of the presence of prostatic masses.[11] The fact that the prostate was not removed secondary to disease until the 20th century is interesting, as the presence of a diseased prostate was documented much earlier. In 1853, Dr. J. Adams, a surgeon from London, discovered what he described as a "very rare disease." His findings were the first that documented the diagnosis of prostate cancer.[3]

Despite the advancements in the understanding of the prostate's anatomy, advancements in diagnosis, and advancements in treatments/ technology, the occurrence of prostate cancer continues to increase. Prostate cancer is the second most common cause of cancer death in men in the United States (second only to lung cancer).[12] Prostate cancer affects Black men at a greater rate than all other races and ethnicities.[13] Furthermore, Black men with prostate cancer are more likely to die from prostate cancer than all other races and ethnicities (followed by Whites, Hispanics, and Asian/ Pacific Islanders).[13] Although the diagnosis of prostate cancer continues to increase, survival rates of prostate cancer have also increased. Diagnoses are made much earlier due to greater understanding of how hormones are related to and affected by prostate cancer and also due to better screening, prostate exams, and improved treatment options.[14] The availability of technology and diagnostics has increased the overall ability to diagnose the disease, and thus, is likely a contributory factor in the increase in the number of cases of prostate cancer in the United States.

A number of options are available for the treatment of prostate cancer. Common treatments include: brachytherapy, hormone therapy, bilateral orchiectomy, chemotherapy, cryotherapy, general surveillance, and surgical removal of the prostate and/or the surrounding tissue.[12,14] Modern surgical approaches to remove the prostate include the perineal, open retropubic, laparoscopic, and robotic approaches. For the purposes of this article, the focus will be on robotic versus open retropubic prostatectomy.

Diagnosis to surgery

Patients often present in the office of a primary care provider with early signs of urinary retention or feeling unable eliminate all of their urine. The patient may also experience increased perineal sensitivity or a feeling of fullness. Upon physical exam, abnormalities may be discovered upon digital rectal exam. These abnormalities include an increase in size, a hardening or friability of the prostate, or abnormalities in the texture, such as nodules and pain upon palpation or blood.

According to the American Urological Association (AUA), digital rectal exams and increased prostate-specific antigen (PSA) levels along with risk factors (including a patient history, focusing on ethnicity, age, and family history of prostate cancer) should be used when deciding whether or not to proceed with a biopsy.[12]

Many patients with prostate cancer are coming to the clinic prepared and ready to explore their candidacy for robotic surgery.

If indicated, a cystoscopy and prostate biopsy often follow to rule out or confirm the presence of prostate cancer. After analysis of the prostate tissue via a microscope, a Gleason Score and a Tumor Node Metastasis (TNM) stage are assigned.[12] PSA level, clinical stage, and Gleason score are used to determine the overall prognosis for men diagnosed with prostate cancer.[13,15]

The Gleason Score. The Gleason Score is considered the "gold standard" for differentiating prostate cancer. According to the AUA, five patterns of tissue exist.[12] During the initial diagnosis, the tissue pattern is viewed under a microscope and given a score of 1 through 5.[12] The score is based on how much the tissue has deviated from normal prostate tissue. For example, a score of 1 would closely resemble normal prostate tissue and be less aggressive, and a score of 5 would show more irregular growth and be more aggressive.[12] The second pattern of tissue is then viewed and assigned another score between 1 and 5. The scores of the two microscopic tissue patterns are then summed together to determine the overall Gleason score. The overall Gleason score values range between 2 and 10.[12] Scores less than 6 indicate the potential for a better response to treatment, and scores between 7 and 10 are indicative of unfavorable outcomes.[3]

The AUA stresses that both the individual scores of the two tissue samples and the summative scores of the samples are equally important in determining prognosis. For example, a very high score of tissue sample one (8) and a low score of sample two (1) are equally as important as 2 samples of 5 each.[12] A TNM score is used in prostate cancer staging and takes into account how the cancer was discovered as well as findings from the digital rectal exam. According to the AUA, a prostate disease classified as T1 is confirmed if the disease was found inadvertently during microscopic exam for benign surgery (involving less than 5% of the one gland) or during a biopsy performed for an elevated PSA (T1c).[12]

The diagnosis of T2 disease is based upon the discovery of the cancer during palpation of the prostate on a digital rectal exam. A T2 disease is further classified as T2a (involvement of less than half of one side); T2b (involvement of more than half of one side); or T2c (involvement of both sides of the prostate). T3 disease is diagnosed when the cancer is palpable outside of the prostate laterally or involves the seminal vesicles.[12]

Based on the patient's overall history, including the patient's risk factors and overall general health coupled with a Gleason Score, treatment options are explored and discussed with the patient and the patient's family. The most appropriate plan for treatment is based on the patient's age, overall health and life expectancy, comorbidities, the grade and stage of the cancer, and an evaluation of the risks and benefits of each option. Patients have reported that decisions are difficult based on the availability of more than one choice for treatment.[14]

Overall, patient expectations with the course of treatment and the benefits/risks of each available treatment are explored. Furthermore, patient family and friend support, the distance from the treatment center, and the presence of insurance (or other financial factors) may influence a patient's decision regarding the next step in treatment.

Robotic vs. open prostatectomy

In today's technology-laden world, information regarding surgical procedures is abundant, and patients are more educated than ever. Many patients with prostate cancer are coming to the clinic prepared and ready to explore their candidacy for robotic surgery. Many patients are interested in robotic surgery due to its benefits, which include: reduced pain and trauma, less blood loss, less postoperative pain, reduced infection risk, shorter hospital stay, faster recovery time to normal functioning, and less scarring of the prostate and surrounding tissues.[14] Men who are younger in age and in better physical health have fewer or no comorbidities and are diagnosed with a small prostate with lower grade; patients who have low-volume tumors are the best candidates for surgery.[12]

Potential contraindications for robotic surgery include a higher grade cancer that has spread beyond the prostate, a body mass index greater than 40, a history of radiation treatment or previous hormone therapy, a large prostate, or a narrow pelvis.[14] Characteristics of ideal patients for robotic candidacy minimize the risk of poor surgical outcomes. Ultimately, the surgeon makes the final determination on whether a patient will be a robotic candidate or not. Provided that a patient is deemed a suitable candidate for robotic surgery, it is best to have the procedure at least 6 weeks after any biopsy was taken to allow for any swelling to dissipate. This allows the surgeon better visualization and access to the prostate.[14] Leading up to the day of surgery, patients should receive instructions to stop the use of any anticoagulants or antiplatelet agents unless they are at an increased risk for deep vein thrombosis or pulmonary embolism.[14] This decision would be made by the surgeon, often in collaboration with primary care provider or consulting medical specialist.

Important preoperative considerations for the perioperative nurse include a review of current medications and preoperative lab work, including a complete blood cell count, chemistry and liver profile, coagulation studies, and an ECG.[14] Care of the urinary drainage catheter should also be discussed to ensure the patient knows what to expect postoperatively, as it will aid in the healing of the urethral anastomosis.[16] Many patients experience anxiety in regards to the placement of a urinary drainage catheter and being able to have a discussion as to what to expect will help lower their anxiety. Discussing appropriate urinary drainage catheter care and the purpose of the catheter is an essential role of the nurse prior to discharging the patient. Urinary drainage catheter teaching may also include the patient's family member(s), especially if the patient has recently undergone a procedure requiring general anesthesia or any other type of sedation that may affect the patient's remote recall.

Managing robotics

The perioperative nurse and scrub technician are responsible for setting up and counting all the robotic instrumentation, draping the robot, and maintaining the sterile field. The perioperative nurse also gathers all medication and positioning equipment and checks that all robotic equipment and video monitors are plugged in and in good working order before the patient even enters the procedure room.[16] Once the patient enters the OR suite, the patient is met with a large team that often consists of two circulating nurses, a scrub nurse or a scrub technician, anesthesia personnel, and often, up to three or more surgeons depending on the facility. The perioperative nurse ensures that a sequential compression device has been placed on bilateral lower extremities prior to the induction of anesthesia and that the patient has received an appropriate antibiotic within one hour prior to incision per the recommendations from the Surgical Care Improvement Project.[16,17]

To gain optimal visualization with the robot, the patient is placed in a steep Trendelenburg position. To achieve this, the patient is placed on top of a foam pad to ensure that the patient does not slip during surgery. Care is also taken to pad the patient's arms and face from the movement of the robotic arms.[18] It is essential that the perioperative nurse ensures this extreme patient positioning does not compromise lung function or circulatory function. Another risk of steep Trendelenburg is postoperative visual loss (POVL). It is important to monitor intraocular pressure (IOP) during surgery because an IOP above 40 mm Hg is considered critical.[19] Signs of an increased IOP include eyelid edema, chemosis, and ecchymosis. Recommendations have been made for a five-minute supine rest intervention at intervals during the procedure to aid in reducing IOP and help prevent POVL.[19] After the patient is positioned, the nurse is responsible for prepping the patient's abdomen before surgical drapes are placed. During the procedure, the urethra is cut, and I.V. fluids are closely monitored and restricted to 600 mL to 800 mL of fluid. This is done to decrease the amount of urine production to assist the surgeon to maintain optimal visualization of the prostate throughout the case.[14] Blood loss is also monitored, and if needed, the perioperative nurse coordinates with the blood bank to obtain units for transfusion. After the procedure, the patient is moved from the operating table to a stretcher, and a thorough skin assessment is made to ensure that no injuries have occurred during the procedure.

Continuing education and training ensures that the perioperative team remains proficient in robotic surgery.

Upon arrival to the postanesthesia care unit (PACU), the patient's airway is assessed, and the vital signs and oxygen saturation are routinely checked to ensure stability. Assessment and management of pain and routine observation of urine and abdominal drain output are responsibilities of the PACU nurse caring for the patient. Abdominal discomfort is common due to the use of carbon dioxide (CO_2) that is used to distend the abdomen during the procedure. A belladonna and opium suppository is routinely given by the perioperative nurse at the end of the case to help decrease any postoperative pain or discomfort and to minimize the occurrence of bladder spasms.[14] I.V. medication, such as morphine, can also be given postoperatively for increased pain levels. In regards to abdominal drain output, an increase in drainage could indicate a leak at the urethral anastomosis site. It is important to note that after robotic surgery the patient will have increased drainage output from the closed suction drain with bulb directly after surgery in comparison to a patient who received an open retropubic prostatectomy. This often is due to leftover irrigation that was not removed.[14]

The patient who had robotic surgery is discharged 1 to 2 days after surgery if no complications arise. Instructions for urinary catheter drainage care and the importance of minimizing any pulling or straining of the catheter should be stressed along with notification that a small amount of blood in the urine is common and may continue for several weeks.[14] Prescriptions for oral pain medications should be written to aid in at home pain management. Return to regular daily activities can vary based on surgical approach. Patients who have a retropubic prostatectomy often return to normal daily activities within 6 to 8 weeks, and patients who have a robotic prostatectomy return to daily activities after 10 days.[16]

Robotic vs. retropubic

Opinions on the superiority between the robotic and open retropubic approaches to the prostatectomy tend to differ. Patients are handled the same throughout the preoperative process whether they are having a robotic or retropubic prostatectomy. Intraoperatively, for open cases the patient is positioned in the supine position instead of lithotomy with steep Trendelenburg for robotic cases. One vertical midline incision is made in the lower abdomen that can range from 5 to 8 inches instead of five small incisions. However, when the robotic incisions are totaled in length, they are often close to the same size as the open incision.[5] Blood loss is often higher for open cases compared to robotic cases, as the CO_2 filling the abdomen helps with increased abdominal pressure that ultimately decreases venous blood loss. Postoperative care for both procedures is similar. The primary focus is pain control. Postoperative pain scores are similar for both approaches, and length of stay is roughly 1.23 days for an open retropubic prostatectomy versus 1.17 days for a robotic approach.[5] (See *A comparison of postoperative patient characteristics by procedure.*)

The current body of literature focusing on the care of the patient with prostate cancer underscores holism in successful treatment. The inclusion of family caretakers and patient (trained and community)

A comparison of postoperative patient characteristics by procedure[5,22]

Characteristic	Robotic	Open retropubic
Median time to erectile function	180 days	440 days
Median time to intercourse	340 days	700 days
Return of full continence	92%	80%
Inpatient length of stay	1.17 days	1.23 days
Pain score postoperative day (POD) #1	1.75 (mean)	1.75 (mean)
Pain score POD #14	2.5 (mean)	2.4 (mean)
Survival rates at 24 and 60 months	87% and 73%	87% and 71%

navigators as part of the care plan is key to increased outcomes for the prostate cancer survivor, especially among Black men.[20] Black men have the highest rate of prostate cancer in the United States and the highest rate of mortality secondary to prostate cancer.[13] Understanding the unique needs among populations based on cultural and ethical considerations is essential for the nurse caring for prostate cancer survivors, many who will undergo prostatectomies.[21]

Understanding the patient's preference for family involvement may be useful for the perioperative nurse when communicating with the family or provider or when deciding what to emphasize when caring for the patient. Furthermore, during handoff communication, the perioperative nurse will be well equipped to answer patient-specific questions related to cultural values with an enhanced understanding of holism and unique needs among patients with prostate cancer.

Currently, a great deal of debate between robotic and open approaches to radical prostatectomy exists in the literature. In one nonrandomized prospective trial, Sivaraman and colleagues found that when evaluating erectile function (time to intercourse and continence), the robotic approach was favored by men who had undergone a prostatectomy.[22] Finkelstein and colleagues concluded that there was not much of a difference in approaches in regards to length of hospital stay and mean pain scores assessed postoperatively.[5] Both studies concluded that the approach to removing the prostate was not as important as the skill and experience of the surgeon performing the surgery.

Moving forward

Currently, little evidence exists that strongly supports the superiority of robotic versus open prostatectomies. Patient postoperative complications do however seem to differ. The time the patient expects that his normal functioning will return may be a major factor influencing the type of procedure that the patient prefers. The majority of articles that were reviewed all stressed the skill of the surgeon in either approach being the key to a successful surgery. Cultural factors and the odds of survival are considered when determining the approach to the removal of the prostate. Nursing care should be planned around the unique needs of each patient, and care plans should be tailored based on the patient's needs and beliefs.[19] The length of catheter placement, the patient length of stay, and postoperative complications will be determined largely by the patient's overall health and the approach.

Looking ahead, the development and implementation of a robotics program for prostatectomies should ensure that a facility is well equipped beforehand. A well-equipped facility includes a specialized surgical team that has been trained in robotics, patient robotic case-volume, well-trained surgeons, and a penchant for continuous education. These essentials are common to the framework of robotics programs in the United States. Continuing education and training ensures that the perioperative team remains proficient in robotic surgery. **OR**

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