This article provides oncology nurses with an overview of high-dose-rate brachytherapy for the treatment of prostate cancer. Many treatment options are available for men diagnosed with prostate cancer. Oncology nurses must know about this potential treatment option so they can provide appropriate education, support, and self-care management advice. Program requirements, patient eligibility, and essential planning recommendations are discussed.

About 192,280 men in the United States were diagnosed with prostate cancer in 2009 (Jemal et al., 2009). As treatment options and outcomes are studied, numerous treatment combinations for prostate cancer have become standard depending on disease stage, Gleason score, patient age, and comorbidities. Surgery (open and laproscopic), androgen deprivation, cryo-therapy, and radiotherapy (external beam and brachytherapy) are standard treatment options available. After considering the options, a patient and his family can choose from active surveillance, interstitial prostate brachytherapy, external beam radiation therapy, and radical prostatectomy, with treatment generally commencing two to three months after diagnosis. High-dose-rate (HDR) brachytherapy offers precise delivery of radiation and improved treatment outcomes for selected patients. This article will discuss the development of an HDR brachytherapy suite for the treatment of prostate cancer.

The technologic advances of radiation therapy (RT) are ever evolving, and the next generation of technology is emerging as each treatment plan, machine, and idea are perfected. The authors’ institution currently offers low-dose-rate (LDR) gynecologic and prostate brachytherapy treatment options, as well as a high-dose-rate (HDR) gynecologic brachytherapy program. The institution is developing a plan for HDR prostate brachytherapy, which will expand the HDR brachytherapy program.

Men with prostate cancer are referred for brachytherapy according to a combination of their clinical and pathologic diagnoses. Many patients come to the consultation appointment requesting brachytherapy after they have done extensive Internet searches; they believe that brachytherapy is the quickest and easiest way to obtain treatment for prostate cancer. Brachytherapy has a more favorable toxicity profile for bowel and sexual function (Tsui, Gillan, Pond, Catton, & Crook, 2005) than surgery or external beam therapy. The favorable toxicity and short treatment cycle are reasons men mainly prefer brachytherapy.

Brachytherapy is the temporary or permanent placement of radioactive sources within or near a tumor. It also is known as internal RT or implant therapy and offers the advantage of delivering a high dose of radiation to a specific tumor volume, with a rapid falloff in dose to adjacent normal tissues. Brachytherapy has been used since the early 1900s, following the discovery of radium by Marie and Pierre Curie (Dunne-Daly, 1997). The first reported prostate brachytherapy was in 1910 and used a radium source inserted through a urethral catheter. Radiation safety issues associated with handling the isotope and complications observed with the crude implantation technique soon caused the procedure to fall out of favor (Zelesky, Valicenti, Goodman, & Perez, 2004). In the early 1960s, seeds were placed directly into the prostate with the retropubic, “free-handed” approach.
Currently, prostate cancer treatment with brachytherapy involves the placement of sealed sources of radioactive material within the prostate either permanently in the form of seeds (LDR) or temporarily (HDR) with catheters and radioactive strands housed in a remote afterloader. A remote afterloader is a device that contains a storage safe for sources, an electromechanical transfer system, and an operating control panel (Glasgow, Bourland, Grigsby, Meli, & Weaver, 1993). The storage safe is placed in the secured area where the prepared patient lies awaiting treatment. During treatment, the operating control panel sits outside the secured room with audio and visual contact with the patient. Often times, external beam radiation is combined with brachytherapy to obtain maximum dose distribution to the tumor. The basic radiobiologic principles of repair, repopulation, redistribution, and reoxygenation (the four Rs of radiobiology) have a different tissue response when radiation is administered on a continuous basis either in HDR or LDR brachytherapy, as opposed to fractionated on a daily basis (external beam radiation) (Dunne-Daly, 1997). Supplemental external beam therapy is considered in many cases, and this can be scheduled in a variety of ways. Theoretically, when a patient receives both external beam RT and HDR, the HDR may be incorporated into the RT treatment course. This combination treatment plan (external beam plus HDR) would call for the administration of two or three HDR treatments within the five-week external beam therapy course and the administration of one or two HDR treatments during the second and fourth weeks of external beam therapy.

**Program Requirements**

Members of urology, medical oncology, anesthesia, radiation oncology, nursing, nuclear medicine, and diagnostic imaging disciplines all must make their unique contributions in the correct sequence along the continuum of care for the pieces to fit together (Davis, 1998). Key personnel in a brachytherapy program are professionals from radiation oncology, including physicists, dosimetrists, and nurses, as well as urology and anesthesia staff who are educated in the specialty of HDR brachytherapy. To further offer quality dose delivery of radiation, an option currently exists to perform a cone-beam computed tomography (CBCT) scan of the patient while he is in the treatment position moments after dose delivery, thus verifying implant quality. CBCT obtains a spiral three-dimensional (3D) scan, thus presenting an accurate real-time image of the implanted prostate.

Equipment and space needs are specialized. Ideally, space would be available for an integrated suite, which could be dedicated to the HDR procedure. Because of the nature of
the treatment, the use of the CBCT, and the principles of radiation safety, the suite requires shielding (Duke University, 2009). A variety of treatment planning systems are available. A comprehensive treatment suite streamlines the treatment process and should incorporate imaging, treatment planning software, and the remote afterloader. This allows the provider to have the capability to obtain a CBCT scan immediately after the procedure, providing definitive feedback on implant quality. The CBCT and ultrasound images are fused to obtain a 3D image of the patient’s prostate. With HDR brachytherapy, Iridium (Ir-192) is the treatment source used.

Spinal, local, and general anesthesia are excellent options for use with prostate brachytherapy and manage the localized pain from insertion of the needles; however, general anesthesia addresses emotional needs plus the localized physical discomfort. Therefore, an ideal suite would have pre- and postoperative monitoring equipment for patient safety and accurate recording of vital signs.

The Occupational Safety and Health Administration (2000) has developed guidelines for the safety of staff in the operating room by minimizing exposure to anesthesia gas. Operating rooms must include fresh air intake and an exhaust air outlet to ensure acceptable air quality for the safety and health of staff and patients. Remodeling existing rooms to meet standards for operating room suites can be difficult, if not impossible. Within the brachytherapy suite, the anesthesiologist delivers anesthesia and the radiation oncologist and urologist place catheters, plans treatment, deliver treatment, and follow the patient through recovery within the same physical area. The radiation nurse is involved in all phases of the procedure and an ongoing part of the process, serving as a patient advocate, educator, and navigator of care.

### Patient Eligibility Criteria

Radiation oncologists consider many factors when determining whether a patient is a suitable candidate for prostate brachytherapy (Zeroski, Abel, Butler, Wallner, & Merrick, 2005). Eligibility criteria involve prostate volume, prostatic acid phosphatase level, pubic arch interference, current obstructive urinary symptoms, prior transurethral resection of the prostate, age, comorbid diseases such as diabetes mellitus, obesity, inflammatory bowel disease, and patient desire. In addition to primary treatment, the precision offered by HDR is especially appropriate for the salvage setting, given the potential danger to normal structures that already have received full-dose radiation during primary therapy (Lee et al., 2007).

### Staff Education

HDR brachytherapy calls for knowledgeable and skilled staff to administer the treatment and care for patients. Education plans and in-services for each subspecialty of personnel must be developed well in advance of the first implant and must be ongoing to keep personnel current with changes. Nurses, therapists, dosimetrists, and physicists each need specific training and procedures to follow related to care delivery and safety as well as ongoing communication (see Figure 1). The mutual goal of the team is for patients to undergo successful implantations with as few side effects as possible and, ultimately, to cure the disease (Zeroski et al., 2005).

### Patient Education

When a patient is to receive HDR brachytherapy, he must understand the procedure and his responsibilities during the preparation for and delivery of brachytherapy. The nurse is vital in this step to reinforce education, provide accurate verbal and written information, and to offer contact numbers for patient and family questions that may surface when the patient leaves the clinic setting. In developing a culturally appropriate educational plan, the nurse should take into consideration not only the physical and psychosocial needs of the patient, but also the patient’s educational level and preferred learning method (Gosselin & Waring, 2001).

### Plan for Success

Prior to any radiation procedure, including prostate HDR brachytherapy, a plan must be developed. For conventional RT, the planning process starts with what is referred to as a simulation; for prostate brachytherapy, it is called a volume study. An ultrasound machine with a rectal probe is necessary to perform a volume study. The volume study determines the location and number of needles that will be placed during the procedure. The patient is placed in dorsal lithotomy position. He must be positioned so that his shoulders are in straight
alignment with the buttocks to provide appropriate prostate imaging (Colella & Scrofine, 2004). About one or two weeks prior to the scheduled brachytherapy date, the patient is given detailed instructions for diet and bowel cleansing in preparation for the volume study (see Figure 2). During the visit for the volume study, the HDR preparation and procedure, including preoperative anesthesia requirements, are reviewed in detail with the patient and his significant other(s) (Colella & Scrofine, 2004) (see Appendix 1).

Once the patient has been selected, the care team should adhere to the following guidelines. First, the radiation oncologist and nurse conduct patient education and obtain consent prior to the volume study appointment. The nurse then oversees a checklist to make sure all components of consent, education, and scheduling are in place. The patient receives written instructions regarding bowel and diet preparation as well as scheduling for the volume study. On the day of the volume study, the patient and caregiver receive further instructions for bowel and diet preparation, as well as scheduling details for the actual HDR brachytherapy procedure. Because of the increased risk of infection with this invasive procedure, antibiotic therapy is prudent. Preoperatively, patients receive IV antibiotic prophylaxis; postoperatively, they continue oral antibiotics for 5–10 days as determined by the healthcare team. Because of immobilization, intermittent compression devices are placed on the patient’s lower extremities during the procedure and throughout the post-treatment period to minimize lower-extremity thrombus formation. A three-way irrigating Foley (18–22 gauge) catheter is placed after cystoscopy, and continuous bladder irrigation with normal saline should be performed to keep urine pink or clear (Mate, 2003). A peri-and postoperative pain management plan is essential, and many options are available (Colella et al., 2006; Mate, 2005). Postoperative nursing care includes assessing and managing pain, bleeding, nausea, fever, activity, and diet. This is accomplished by observation, monitoring of vital signs, and experienced

nursing knowledge of expected versus unexpected postoperative signs and symptoms.

The brachytherapy treatment date is based on the finalized volume study and plan. The patient arrives in the clinic; any further questions are answered; he changes into a hospital gown; a time-out is called, ensuring that the right patient and the right procedure are planned; an IV (20-gauge angiocath) is placed; and a three-way irrigating Foley catheter (18-22 French) is inserted. The patient then receives the proposed anesthesia, is placed in dorsal lithotomy position, and has his perineum shaved and the surrounding area scrubbed and prepped. Towel clips are used to secure the scrotum and testicles out of the way. The ultrasound probe then is inserted into the rectum to obtain imaging for the purpose of inserting the needles to stabilize the prostate as well as to receive the radioactive strand of Ir-192 (see Figure 3). After the needles are inserted and replaced with catheters, the patient is taken out of lithotomy position and a flexible cystoscopy is performed to ascertain final needle tip placement (Mate, 2003) (see Figure 4). After placement verification of the needles and catheters and approval of the plan by the physician, the treatment is ready to be delivered. The catheters are connected to the catheters in the HDR machine or safe, wherein the radioactive source is housed. All personnel leave the room at that time, and the patient is on constant video and audio surveillance. The HDR machine is preloaded with the patient’s specific plan. Only after a physics and physician quality-assurance check is the treatment commenced. Each needle and catheter in the patient receives the treatment source in a planned pattern (see Figures 5 and 6). Depending on the number of needles and catheters, the planned dose can take take approximately 20–30 minutes.

Upon the completion of treatment, the implant needles and template are removed from the perineum. The patient is placed on a stretcher and taken to the recovery area, where lower-extremity compression devices are applied and the patient is monitored as he recovers from anesthesia. The nurse places ice compression on the perineum for comfort and to minimize bleeding and swelling, as well as antibiotic ointment on the needle sites, if not contraindicated by allergy. When the patient is fully recovered, the Foley catheter, lower-extremity compression devices, and IV are removed. The patient and caregiver then receive verbal and written postoperative and follow-up instructions (see Appendix 2). The patient is discharged when able to void and ambulate.

Irritative or obstructive urinary symptoms are the most common side effects immediately after prostate brachytherapy. The symptoms vary significantly from patient to patient and may persist for as long as two years after treatment (Abel, Dafoe-Lambie, Butler, & Merrick, 2003). Comprehensive nursing management for patients before, during, and after the procedure is necessary to achieve high-quality outcomes and patient satisfaction (Colella & Scrofine, 2004).

Follow-Up

Regular check-ups after RT are important to monitor a patient’s status. The first follow-up visit should be about six weeks after treatment with either the radiation oncologist or urologist. Blood tests and rectal examination are the primary methods
used to follow the course of the cancer and are performed during follow-up visits. Typically, PSA will decrease significantly in the first one to two years, with a gradual decrease thereafter.

Billing and Coding

The prostate HDR brachytherapy implant procedure requires an array of current procedural terminology codes. Although nurses in the authors’ institution are developing a list of nursing charges, nurses would be prudent to become familiar with the entire billing process.

Conclusion

HDR prostate brachytherapy is well tolerated, is minimally invasive, and can be performed on an outpatient basis. With a brachytherapy program in the clinic setting, this method of prostate cancer treatment will be available for the region served. In addition, the door will be open to increase accessibility for brachytherapy treatments for other eligible cancer diagnoses. A multidisciplinary team is necessary to see the broad picture when setting up a new program.

When professional nurses are involved in planning and implementing clinical procedures, patients, families, and the institution benefit. The professional nurse is a critical thinker and a global planner, as well as a compassionate human being. Nurses will take a plan and make it reality through comprehensive education, creative resourcing, and fierce commitment.

The authors take full responsibility for the content of the article. The authors did not receive honoraria for this work. The content of this article has been reviewed by independent peer reviewers to ensure that it is balanced, objective, and free from commercial bias. No financial relationships relevant to the content of this article have been disclosed by the authors, planners, independent peer reviewers, or editorial staff.

Author Contact: Jayne Waring, RN, BSN, OCN®, can be reached at waring@radonc.duke.edu, with copy to editor at CJONEditor@ons.org.

References


The following information will outline the course of events for your high-dose-rate (HDR) prostate brachytherapy implant.

**Before Your Implant**

One or two weeks before your implant, you will meet with your doctor and nurse to review the procedure, finalize paperwork, and ask questions. You will be given preoperative diet and bowel-cleansing instructions. You also will meet with the anesthesia department for evaluation, which will include laboratory work, chest x-ray, and an electrocardiogram. Other tests may be required according to your specific health situation. The anesthesiologist will explain the plan for sedation and anesthesia for your procedure.

**The Implant Procedure**

The implant will take the better part of a morning or afternoon. An IV line will be placed so that you can receive fluids, antibiotics, and pain medication through your veins. You may receive mild sedation prior to anesthesia. Once you have had anesthesia and are asleep, the procedure will begin. First, a catheter tube will be placed into your bladder to drain urine, then the tubes will be inserted into the prostate. You will be required to stay in a special bed to avoid movement of the tubes. You will wear special support stockings while confined in bed; when you awaken, you will be encouraged to take deep breaths frequently.

Radiation treatments will be given by attachment of the tubes in your body to the machine that holds the radiation source. The treatments will take about 30 minutes. You will not feel anything, although you will hear the machine making clicking sounds. During the treatment, the staff will be outside the room but in constant contact with you by way of a video camera and voice monitor. When the treatment is complete, the implant will be removed. The catheter in your bladder and IV will be removed around that time as well, depending on a number of factors. Once the catheter is removed from your bladder, you may be asked to remain in the clinic until you are able to pass urine on your own.

Most men experience mild to moderate discomfort during the procedure. Safe and appropriate pain management will be provided throughout your stay. You will be given a prescription for pain pills so that you will have them before discharge from your procedure.

**After Your Implant**

You may experience some difficulty passing urine immediately after your implant or a burning sensation when you pass urine the first few times. Small amounts of blood or clots may appear in your urine initially. This usually resolves in a day or two. Other common side effects are the need to urinate more frequently and a strong urge to urinate (urgency). You also may experience more difficulty emptying your bladder. Side effects usually are moderate.

Rarely, complete blockage of urination may occur. If you are unable to pass urine on your own six hours after discharge, go to an urgent care center or the hospital emergency room.

Brisk and a feeling of fullness in the area of the implant where the needles entered the body (the perineum) are common. Placing ice on the area is recommended to reduce swelling and inflammation.

After completion of your HDR brachytherapy implant procedure, no radioactive sources will be inside you. Therefore, you will not be radioactive, nor will your bodily fluids (e.g., urine, stool, semen, sweat, sputum).

You must have someone accompany you to this procedure because you will need a driver. The anesthesia and pain medication will alter your ability to operate a motor vehicle safely.

Avoid heavy lifting and strenuous activity for two to three weeks after your implant. After that, you may return to normal activity. Occasionally, vigorous activity may cause some minor blood in the urine. If this lasts for more than a day, contact your doctor.

You may resume sexual activity any time you feel ready for it. Initially, your semen may be discolored dark brown or black. This is normal and a result of bleeding that may have occurred during the implant being released into the ejaculate.

**Follow-Up Care**

Have regular checkups after your radiation treatment to monitor prostate cancer status. The first visit may be anytime from the day after the procedure to six weeks after, depending on a variety of reasons. Blood tests along with a rectal examination are the primary ways to follow the course of the cancer and will be performed during your follow-up visits.

Your primary care nurse will review discharge instructions with you and your caregiver. Follow-up instructions, appointments, and contact numbers will be given to you at that time. A meeting with your radiation oncologist will be arranged for the day after your procedure to evaluate your status. Therefore, if you do not live locally, you may wish to make arrangements to spend the night of your implant near the clinic.

**Appendix 1. Patient Education Sheet: High-Dose-Rate Prostate Brachytherapy Procedure**

*Note:* This is a draft of a document currently under development.
Please Follow These Instructions After Your Implant.

- You will need to arrange for someone to drive you home after the implant.
- You are not radioactive.
- You may shower in the evening when you go home.
- You may resume your regular diet as tolerated.
- Your provider will arrange for your follow-up visit.

Possible Side Effects and Actions to Take

- Some pinkish color or blood in your urine is common for a few days following your implant. Increase your fluid intake to at least eight 8 oz. glasses (limit caffeine) to clear your urine.
- Frequent urination, burning, and dribbling commonly occur four to seven days after your implant. A pad will protect your undergarments. Frequent urination may continue for three to six weeks.
- Inability to urinate because of swelling or blocking of the urethra is rare. If you cannot urinate, go to an urgent care center or the emergency room to have a small, soft bladder catheter tube inserted to drain your urine. The tube will be attached to a leg bag, which you will wear one to two days. Please also notify your radiation oncologist at __________ should this problem occur.
- You may experience some diarrhea for three to seven days. Medications such as Imodium® (over-the-counter loperamide, McNeil-PPC, Inc.) or Lomotil® (prescription diphenoxylate hydrochloride and atropine sulfate tablets, Pfizer Inc.) are available to treat this if necessary.
- Mild or moderate pain at the implant site may occur. Apply an ice pack intermittently to the area to relieve swelling and discomfort. Acetaminophen will relieve most of the pain. You will be given a prescription for a stronger medication to be used for more severe pain.
- After your implant, you will be given a prescription for antibiotics to prevent infection. Take all of the pills as prescribed. Call if you have problems with the antibiotic (e.g., rash, nausea, increased diarrhea) (__________, ask for radiation oncologist on call).
- Some mild bleeding at the implant site can occur. Applying steady pressure to the area with a washcloth or gauze pad will stop the bleeding. Call if the bleeding does not stop (__________, ask for radiation oncologist on call).
- Some bruising and swelling of the testicles frequently occur. This could last three to four weeks, resolves on its own, and requires no specific treatment.
- Numbness of the penis occasionally occurs and could last one or two months. The numbness will resolve on its own and requires no specific treatment.
- For any additional concerns not discussed here, please contact your radiation oncologist or radiation oncology nurse at __________.

Appendix 2. Patient Discharge Information: After Prostate Implant

Note: This is a draft of a document currently under development.