# Brachytherapy for Prostate Cancer

Mack Roach, III, MD; Katsuto Shinohara, MD; Joe Hsu, MD; and Peter R. Carroll, MD
Departments of Radiation Oncology and Urology
University of California, San Francisco

**Introduction**
Brachytherapy refers to a method of delivering radiation to cancers by placing radioactive sources either directly into the cancer or very close to it. Because the dose rate drops off rapidly as the distance increases from the source, brachytherapy has the advantage of delivering a high dose to the target volume and minimizing radiation to normal tissues adjacent to the cancer.

**Method**
For the management of prostate cancer, brachytherapy can be used as the primary treatment or in combination with external beam radiation or androgen deprivation. The most challenging aspects of brachytherapy are the identification of tumor volume and the accurate placement of the radioactive sources into the treatment target. Recent advances in real time imaging using transrectal ultrasound have allowed urologists and radiation oncologists to accurately identify the target during the implant procedure. Development of a perineal template has also made the process of seed implantation more efficient and accurate. Instead of a freehand approach, a template with evenly spaced holes guides the needles/catheters as they are inserted into the prostate transperineally. (See **Figure 1**) Flexible cystoscopy can be used to identify the tips of the catheters/needles and the bladder neck, allowing accurate superior positioning of seeds.

Once these catheters or needles are accurately placed in the prostate, there are a variety of ways in which radiation can be delivered.

***Permanent Implant:*** Radioactive iodine (I-125), palladium (Pd-103) seeds can be loaded directly into the needle and then left in the prostate permanently. As the radioactive seed decays, it releases radiation into the surrounding tissue. Although this procedure requires anesthesia, it can be performed in a single outpatient visit. The number and the activity of seeds used are based on a volumetric study of the prostate done using transrectal ultrasound before the implant, hence these implants are "pre-planned." A permanent implant can be used as the sole modality for treatment of early stage prostate cancers, or it can be used in combination with external beam radiotherapy for more advanced disease.

***Temporary Implant:*** Radioactive iridium (Ir-192) seeds can be loaded temporarily into the catheters to deliver radiation. Since the sources are loaded after the surgical procedure, the duration and activity of the source can be calculated based on the actual implant geometry. Because the radiation is delivered in a relatively short time period, this technique is often used as a "boost" along with external beam radiation. The procedure also can be repeated. Recent advancement in computer-driven robotics allow high activity sources to be remotely and accurately placed along the length of the implant

catheters. This technology, along with radiographic image-base dosimetry, leads to more accurate and efficient cancer treatment.

Since a uniform dose distribution is important, patients with either large prostate glands or locally extensive cancers may benefit from neoadjuvant androgen deprivation before brachytherapy.

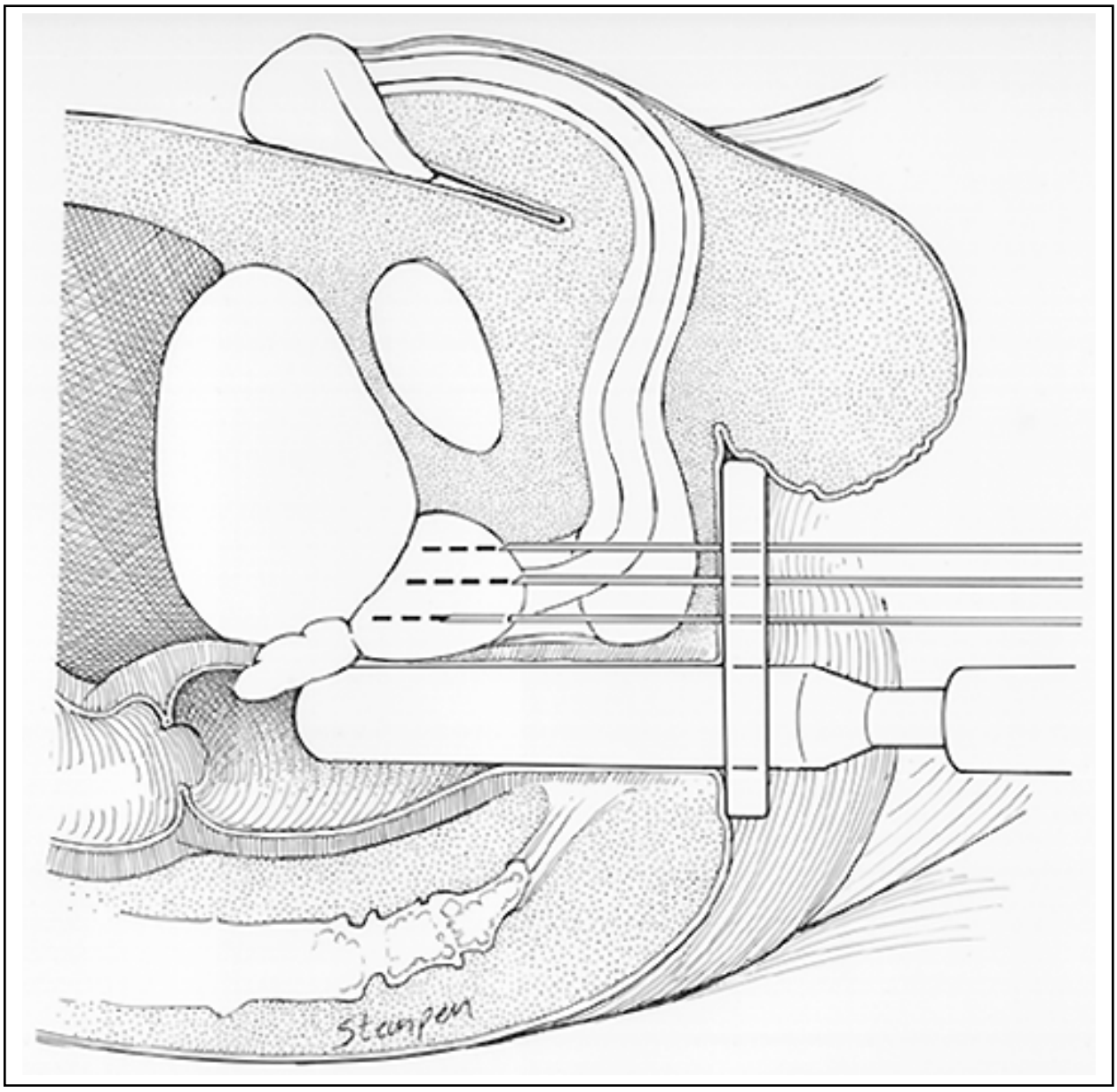
**Efficacy and Patient Selection**
The efficacy of brachytherapy, like all treatments for prostate cancer, is related to cancer grade and stage. The risk of either local recurrence or biochemical failure (high or rising serum PSA) may be as low as 7% for those patients with very limited disease and approximately 20% for those with larger and/or higher grade cancers. Although the median follow-up in many series is still limited to 5 years or less, these results compare very favorably to other standard treatment methods, such as radical prostatectomy or various forms of external beam radiotherapy.

Ideal patients for a permanent implant alone would be those with limited disease (i.e. T1 or T2a cancer stage, Gleason grade
< 7 and a serum PSA < 10 ng/ml). Patients with larger cancers (i.e. T2C or T3A disease, Gleason grade > 7, and serum PSA > 10 ng/ml) may be better candidates for either a permanent palladium implant or a temporary implant, both in combination with external beam radiotherapy.

**Side Effects**
Eighty-one to 90% of patients potent before treatment will remain so after implantation. Long-term potency rates need to be determined, however. Although transitory urinary tract symptoms such as urgency, frequency and decreased force and caliber of the urinary stream are not uncommon, persistent urinary tract symptoms occur in less than 14% of patients. Urinary tract complications appear to be more common in those who have undergone transurethral resection of the prostate previously and, therefore, such patients do not appear to be good candidates for the procedure. The risk of rectal ulceration is minimal.

**Summary**
Modern brachytherapy is the result of advancement in minimally invasive, image-based surgical techniques, radiology and computer science. It requires a dedicated team, including urologic surgeons, radiation oncologists and radiologists experienced in the management of prostate cancer. At UCSF, we have the resources and the expertise to deliver and further refine this exciting new technology.

**Figure 1**




For additional information, call: **415 885 7838** or **415 476 8982**.