

Prostate Brachytherapy: Advancing Prostate Cancer Treatment in the Region

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Prostate cancer remains one of the most prevalent malignancies among men worldwide, and Pakistan is no exception with its incidence among the leading five cancers in men in the country.¹ The incident rates are expected to increase due to improved diagnostic capabilities, ageing population, and lifestyle changes. Despite the advancements in the field, many cases remain undiagnosed until advanced stages; due to limited awareness and initial inadequate screening in the region.² Prostate brachytherapy proposes a practical, more effective, and an accessible treatment solution.

Prostate brachytherapy involves transperineal (TP) placement of radioactive seeds or sources within the prostate under ultrasound or computed tomography (CT) guidance. This allows the delivery of targeted high doses of radiation to the prostate while sparing surrounding healthy tissues like the rectum, bladder, intestine, and others. The brachytherapy procedure is typically performed within one and a half hour as a day procedure under general or spinal anaesthesia; without the requirement of hospital admission. There are two main types of brachytherapy used for prostate cancer; Low-dose rate (LDR) brachytherapy involves the permanent implantation of radioactive Iodine¹²⁵ or Palladium¹⁰³ seeds within the prostate. High-dose rate (HDR) brachytherapy involves the temporary placement of Iridium¹⁹² or Cobalt⁶⁰ radiation sources using temporary interstitial needles. The source is readily available in the centres treating gynaecological malignancy with brachytherapy.

LDR brachytherapy can treat low- and intermediate-risk prostate cancer as a monotherapy (one-time) treatment^{3,4} while high-risk localised diseases are treated by a combination of the initial phase of external beam radiation therapy (EBRT) followed by a one-time brachytherapy boost.⁵

HDR brachytherapy is commonly used as a single boost treatment before or after EBRT in localised prostate cancer.⁶ It is also used as a monotherapy in two sessions of the treatment, one or two weeks apart in low- and intermediate-risk categories.⁷ Both LDR and HDR brachytherapy can be used for salvage treatment of focal prostate gland recurrence after EBRT.⁸

Prostate brachytherapy has shown comparable efficacy to other treatments such as radical prostatectomy and EBRT. Several benefits make brachytherapy a prominent treatment option in the localised prostate cancers. There is no randomised comparison between the efficacy of the currently available treatment options. However, non-randomised comparison reveals that brachytherapy outcomes are at least equal to or a more desired option in some cases compared to alternative treatment options.³ Unlike radical prostatectomy, brachytherapy is a minor invasive procedure, avoiding all complications related to major procedures. Patients often experience fewer side effects including sexual dysfunction compared to other treatment options; enhancing post-treatment quality of life. The targeted nature of brachytherapy delivers high doses of radiation to the prostate gland, while a steep dose gradient beyond the target helps to minimise radiation doses, and reduces damage to the surrounding healthy tissues. Set-up errors are not a challenge since sources are within the gland compared to EBRT. Brachytherapy is performed on an outpatient-basis, with a short recovery time and no requirement of hospital-stay, reducing healthcare costs. Brachytherapy is a one-time outpatient procedure that is convenient to patients compared up to 40 outpatient visits over eight weeks for EBRT or variable duration of hospital admission for prostatectomy. This option saves approximately 20 minutes up to 40 treatment slots on EBRT machines for each patient. It also saves hospital admissions related to prostatectomy. The brachytherapy unit is mobile which allows the procedures to be performed in multiple centres with the same equipment. Brachytherapy is generally more cost-effective compared to other treatment modalities. It can be initiated with minimal upfront investment compared to EBRT machines.

Despite its advantages, prostate brachytherapy is not without challenges. Not every patient is eligible for brachytherapy treatment. A few of the prostate gland volume is more than the desirable 65 cc; the patient is not eligible for anaesthesia; or a narrow pelvic bone arch may make the patient ineligible for this procedure. It is important to follow selection criteria or guidelines to offer this treatment to the suitable patients. Trained medical experts and teams are required to perform this procedure which may not be available in some institutions. Institutions are required to allocate resources, for example, an operating room and anaesthesia support for this programme. Accurate seed placement is critical since it can lead to inadequate dosing of the target or excessive radiation to critical structures.

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Current State of Brachytherapy in the Region:

Despite its potential, the implementation of brachytherapy in the region faces significant challenges. There is a lack of awareness about prostate cancer in general and brachytherapy in particular among healthcare providers and prostate cancer patients. Many healthcare facilities lack the necessary equipment and trained personnel to perform the brachytherapy. Few centres are offering this treatment to their patients, making access difficult for many patients. The cost of brachytherapy (as any other treatment) can be prohibitive for many patients, limiting its widespread adoption.

The prostate LDR brachytherapy programme was successfully initiated for the first time in the region at SQCCRC, Muscat, Oman in November 2022. Patients were treated in the past with CT-based prostate HDR brachytherapy in Karachi, Pakistan at SIUT. However, ultrasound-based HDR brachytherapy for the first time in the region was initiated by KFMC, Riyadh, Saudi Arabia in 2022. This was followed by similar treatment in Mediclinic, Dubai, UAE.

Future Prospects of Brachytherapy in the Region:

Currently, most EBRT treatment machines are overused due to the high number of patients and lower number of machines. Also, the complexities of EBRT are increasing which requires more time to treat individual patients on these machines. Prostate brachytherapy can provide a cost-effective solution of access to EBRT machines by treating eligible prostate cancer patients with one or two sessions of brachytherapy rather than EBRT. This will permit other eligible patients on EBRT machines. In my opinion, the future of prostate brachytherapy in Pakistan and the region is promising, and requires ongoing advancements and strategic initiatives: Increased awareness and education needs to be communicated to the healthcare providers and the general public education about prostate cancer in general and the benefits of brachy-therapy in particular. Regular prostate specific antigen (PSA) tests of eligible patients enhanced imaging techniques, such as mpMRI and TP biopsy of suspected patients will improve diagnosis of patients in earlier stages, which reduces the cost of treatment compared to late stages at the diagnosis. Efforts require expanding healthcare infrastructure and training more specialists will likely improve accessibility. Brachytherapy provides cost-effective solutions for prostate cancer treatment. Providing easier access to brachytherapy may help in reducing cancer treatment costs. Encouraging research and collaboration within regional and international centres can promote knowledge exchange which will enhance the quality of care. One example of regional collaboration is between the Pakistan Society of Clinical Oncology (PSCO) and the Middle-East Society of Radiation Oncology (MESTRO).

In summary, prostate brachytherapy offers a promising, minimally invasive treatment option for the prostate cancer. While the adoption of this treatment in the region faces significant challenges, ongoing efforts in education, collaboration, and healthcare infrastructure development are promising. By addressing these

barriers and leveraging innovations, prostate brachy-therapy can play a crucial role in improving prostate cancer outcomes in the region.

COMPETING INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

NP, SA: Concept, draft of the manuscript, approval and agreement to be accountable for all aspects of work.

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