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Review Article

ACR appropriateness criteria permanent source brachytherapy for prostate cancer

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ABSTRACT

PURPOSE: To provide updated American College of Radiology (ACR) appropriateness criteria for transrectal ultrasound-guided transperineal interstitial permanent source brachytherapy.

METHODS AND MATERIALS: The ACR appropriateness criteria are evidence-based guidelines for specific clinical conditions that are reviewed every 3 years by a multidisciplinary expert panel. The guideline development and review include an extensive analysis of current medical literature from peer reviewed journals and the application of a well-established consensus methodology (modified Delphi) to rate the appropriateness of imaging and treatment procedures by the panel. In those instances where evidence is lacking or not definitive, expert opinion may be used to recommend imaging or treatment.

RESULTS: Permanent prostate brachytherapy (PPB) is a treatment option for appropriately selected patients with localized prostate cancer with low to very high risk disease. PPB monotherapy remains an appropriate and effective curative treatment for low-risk prostate cancer patients demonstrating excellent long-term cancer control and acceptable morbidity. PPB monotherapy can be considered for select intermediate-risk patients with multiparametric MRI useful in evaluation of such patients. High-risk patients treated with PPB should receive supplemental external beam radiotherapy (EBRT) along with androgen deprivation. Similarly, patients with involved

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The American College of Radiology seeks and encourages collaboration with other organizations on the development of the ACR Appropriateness Criteria through society representation on expert panels. Participation by representatives from collaborating societies on the expert panel does not necessarily imply individual or society endorsement of the final document.

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pelvic lymph nodes may also be considered for such combined treatment but reported long-term outcomes are limited. Computed tomography–based postimplant dosimetry completed within 60 days of PPB is essential for quality assurance. PPB may be considered for treatment of local recurrence after EBRT but is associated with an increased risk of toxicity.

CONCLUSIONS: Updated appropriateness criteria for patient evaluation, selection, treatment, and postimplant dosimetry are given. These criteria are intended to be advisory only with the final responsibility for patient care residing with the treating clinicians.

Keywords: Prostate cancer; Brachytherapy; Guideline; Standard; Radiation therapy; Radiotherapy

Summary of literature review

Introduction/background

Improvements in permanent prostate brachytherapy (PPB) using transrectal ultrasound (TRUS) guidance via a perineal template resulted in this procedure becoming a major treatment option for localized prostate cancer by the mid-1990s (1). PPB is an outpatient procedure with short treatment time, rapid patient recovery, and demonstrated long-term efficacy. For men with low-risk disease, treatment efficacy is comparable to other primary treatment options (2–5). Similarly, short-term and long-term toxicity and quality of life (QoL) outcomes with PPB compare favorably with alternative treatment methods (6–8). For men with high-risk disease, dose escalation with brachytherapy combined with external-beam radiation therapy (EBRT) and androgen deprivation therapy (ADT) is associated with improved disease-free recurrence rates (9–11) as compared to EBRT and ADT alone. In the present study, we provide an update from our prior report in 2011 of appropriateness criteria for PPB (12), with consensus views on management strategies.

Patient selection

Other consensus guidelines and recommendations on patient suitability and procedural aspects of PPB include those from the American Association of Physicists in Medicine (13), American Brachytherapy Society (ABS) (14–16), American College of Radiology (ACR)/American Society of Radiation Oncology (17), and the European Society of Therapeutic Radiation Oncology (18, 19). In general, a patient may be a suitable candidate for PPB if (*1*) the patient has clinically localized prostate cancer without evidence of regional or distant metastasis, (*2*) a high-quality implant is technically achievable, and (*3*) the patient is at low risk for significant morbidity as compared to alternative treatment approaches.

A common factor influencing whether a high-quality implant can be performed is pubic arch interference. Pubic arch (bone) interference remains a relative contraindication to PPB because of the difficulty of dosimetric optimization on the lateral and/or anterior extent of the prostate gland (20, 21). The TRUS volume study/simulation and/or pubic arch computed tomography (CT) study may identify those patients whose prostate is accessible to perform a high-quality implant. However, there is known variability in the ability of such studies to predict pubic arch interference (20, 22). Although large prostate volume has been considered a limiting factor, PPB for patients with prostate volume > 100 cm^3 has been reported as performed by experienced practitioners (23). For those patients with narrow pelvic anatomy or a large prostate, re-evaluation after cytoreductive ADT may be appropriate (see Table 1).

Characteristics thought to place a patient at increased risk of morbidity with PPB have included poor baseline urinary function determined primarily by International Prostate Symptom Score (IPSS), history of prior transurethral resection of the prostate gland (TURP), large (>60 cm^3) or small (<20 cm^3) prostates, acute prostatitis, and inflammatory bowel disease (IBD) (24). Currently, no reliable preimplant criteria can be used to predict prolonged urinary retention, but various risk factors have been identified. Predictive factors for acute urinary retention include preimplant obstructive symptoms, IPSS $>$ 15–20, postvoid residual volume >100 cm^3, and median lobe hyperplasia (the protrusion of hypertrophied prostate tissue into the bladder) (25). The preimplant IPSS correlates with the duration of postimplant obstructive symptoms (26, 27), but its impact on long-term urinary QoL is less clear (26, 28). The prophylactic use of alpha-blockers does not significantly affect retention rates but results in a significantly faster return of IPSS to baseline (29).

A prior history of TURP has been considered by some to be a relative contraindication for PPB. The risk of incontinence has been reported to be 6% or less if a peripheral source-loading technique is used, and adequate prostatic glandular tissue exists such that the radiation dose to the TURP defect can be limited to $<110\%$ of the prescription dose (30, 31). Using the Expanded Prostate Cancer Index instrument, patients with a preimplant TURP have been found to have urinary QoL approaching that of non-TURP brachytherapy patients (32).

Prostates that are large (typically considered to be > 60 cm^3) or small (<20 cm^3) have historically been thought of as difficult to implant adequately, and these patients were often not offered PPB. Reports over the last decade, however, have demonstrated good dosimetric and treatment outcomes for men across a wide range of prostate sizes (33–36). In regard to inflammatory conditions, it is