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Cryoablation: Scientific Foundation, Treatment Planning and Clinical Practice

Interest in and utilization of cryoablation as a primary therapy for many types of cancer has increased markedly in the past decade. The procedure has evolved significantly from a technology perspective with engineering advances yielding greater control of ice formation within the body as well as enhanced visualization. This, coupled with isotherm modeling and treatment planning, has resulted in the ability to accurately target tissue for cryoablation. The organ to which these advances are most often applied is the prostate. This is due to the prostate being a relatively difficult structure to treat. The passage of the urethra through the gland necessitates the use of multiple cryoprobes and the procedure is confounded by the sensitivity of adjacent structures including the neurovascular bundles, external sphincter and rectum. Even with these obstacles, modern prostate cryoablation has emerged both as a primary prostate cancer treatment option and as a salvage therapy following failed radiation therapy.

This lecture will review the fundamentals of cryobiology and the seminal work which established clinical endpoints. The technological basis of the procedure will be discussed including both fundamentals of cryoprobe design and compatibility imaging modalities. Lastly, clinical outcomes of the prostate cryoablation will be compared to radical prostatectomy (the gold standard), external beam radiation therapy, brachytherapy and IMRT.

Educational goals:

1. Understand the damage mechanisms of cryoablation and how they differ from radiation damage,
2. Understand the fundamentals of how prostate cryoablation is performed and the technologies used to do so, and,
3. Understand how the outcomes of cryoablation compare to other treatment modalities.