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Irreversible Electroporation (IRE) treatments of 130 patients with prostate cancers in various stages over three years: A safety study

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Introduction & Objectives: The field of prostate cancer in diagnosis and treatment has seen a lot of restructuring in the past years. A higher awareness and steady improvements in medical and biological technologies (PSA screening, MRI, PET scan, Histoscanning, genetic tests.) facilitate the diagnosis of prostate cancer and subsequent treatments. With this technological advancement, men with prostate cancers including low-risk prostate cancers are being more and more treated, which has been controversial and the subject of much debate. These concerns have influenced the treatment approach and brought more interest in less radical approaches like active surveillance or focal therapy, the latter causing an arms race of different ablation technologies. Two new procedures bring drastic changes in the ablation physics and hence very different properties: Photodynamic therapy (PDT) and Irreversible electroporation (IRE). IRE is based on ultra-short and rather strong electrical fields disrupting the cellular homeostasis by creating irreversible micro- and nano-pores in cell membranes, which cause apoptosis and subsequent cell death. The apoptotic cell death produces scaring and pain sensation to a very low level. Tissue heating is so negligible and the margin of the treatment field is extremely sharp. Being based on electrical fields, the effect zone is rather easy to plan and minimize side effects outside the IRE zone. Although IRE is much less tissue specific than PDT, it still comes with the promise of a certain tissue selectivity. Volume geometry and size is dynamically adjustable over a range of a few ten mm^3 up to several hundred ccm^3 using a concept of 2-6 sequentially triggered electrodes. We present our experience with 139 tissue ablations using Irreversible Electroporation (IRE) on 130 patients since May 2011. Objective is to assess the safety of IRE for treatment of prostate cancers in various stages.

Material & Methods: For 130 patients rejecting all other treatment options, IRE (Nanoknife, Angiodynamics) was preformed to treat their various stages of adenocarcinomas (T1aN0MO – T4NXM1c). 25 patients had history of recurrences after other treatments (5 TUTPs, 8 IRE, 4 radiations, 3 HIFUs, 3 prostatectomies alone and 2 prostatectomies and radiations). Multiparametric MRI was performed in 100% of the cases prior and 12 – 24 hours after the IRE. MRI planed 3d-Mapping Biopsies of the prostate were obtained to determine the exact location in 47% of the cases. Whole gland ablations (n=23) or partial gland ablation (n=80) were performed. Mean percentage of ablated tissue was 64%. Treatment field also included urethra, neurovascular bundle, bladder, rectum, urethral sphincter, seminal vesicles and small bowel (n=93, 82, 24, 2, 12, 27, 1, respectively). Clinical and/or MRIs follow-ups were obtained at 3, 7, 12, 18, 26, 36 month intervals. Retrospective analysis was performed on 103 patients, who completed at least first 3-month-followup.

Results: Only 2 of 103 patients (1.9%) needed post-procedural hospitalization (one catheter-induced infection and one recto-urethral fistula): no surgical interventions were needed. Average recuperation and Foley catheterization time was 1-2 days. No pain medications above WHO level 1 required. 12 patients (11%) reported a temporary (n=10, < 9 months) and complete (n=2, >3 years) reduction in potency. 3 patients (3%) reported transient dysuria. 14 patients (13%) reported transient urinary retention. 12 patients (11%) developed transient incontinence (n=8) or urgency (n=4) after procedure. 5 patients (4%) reported dysejaculation. 3 patients (3%) reported post-procedural infection (cystitis, epididymo-orchitis, or other infection).

Conclusion:IRE offers a new effective therapeutic option for treatment of prostate adenocarcinomas in various stages and improved safety profiles, favorable to other conventional treatments. Further long-term prospective studies are needed for oncological & functional outcomes.

Biography

Ducksoo Kim, MD is practicing Cardiovascular and Interventional Radiology at Boston Medical Center and Boston VA Health Care (Director of Interventional Radiology), and currently Professor in Radiology at Boston University of School of Medicine. After graduation from Catholic University Medical School in 1973 and serving as Army Surgeon from 1973 to 1976, he completed Radiology Residency at Beth Israel Medical Center, NJ in 1981 and NIH Cardiovascular and Interventional Radiology Fellowship at Stanford University Medical Center in 1983. He has invented and patented over 15 medical devices. He has written over 100 scientific papers in various medical journals. He also edited a textbook entitled "Peripheral Vascular Imaging and Intervention" and is editing another textbook entitled "Vascular Imaging and Endovascular Intervention" He has been elected as the Top Docs in USA or America's Top Physicians in 2004, 2005, 2006, 2013, and 2014. He received Alumni of the Year Award from Catholic University Medical College and Grant for Grand Challenges in Global Health from Melinda & Bill Gates Foundation in 2013. He has been also elected for Who's Who in America and Who's Who in the World since 1995 and 1996, respectively.

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