AbstractID: 8247 Title: Nomogram derivation for Cs 131 prostate seed implant

Purpose: To derive a nomogram for Cs^{131} prostate seed implant

Method and Materials: Adopting the isotropic point source model from TG43, the integral dose delivered by a single source is
$E= 4\pi\int r^2 \Lambda\Phi_{an}S_k\, g(r)/r^2\, dr$, where g(r) is the radial dose function, given as $0.0002r^4+0.0049r^3-0.0397r^2 +0.0041r+1.0322$ [(1)]. Let N be the number of sources implanted, the total integral dose will be NE. Defining F is the fraction factor for energy absorbed by the prostate, and then energy absorbed inside the prostate will be NEF. Assuming the prostate is spherical and radioactivity is uniformly distributed, fraction factor F with energy 30 keV (Cs^{131}'s average energy) has been calculated by Monte Carlo technique [(2)]. The integral dose inside the prostate will be the volume of the prostate (V) times the mean dose (D_{mean}). The mean dose in the uniformly distributed sphere is calculated using numerical integration [(3)] to be 1.76 times of prescribed dose (D). By equating NEF=V D_{mean}=1.76DV, the nomogram is obtained.

Results: The nomogram (total activity $=0.1128DV^{0.6727}$) is used to compare with clinical data provided by IsoRay (Richland, WA). The agreement is within 10% for monotherapy cases and within 12% for boost cases with regular gland sizes (25 to 60 cc). With gland sizes range from 30 to 60 cc, the agreement improves to 7% for monotherapy cases.

Conclusion: Assuming radioactivity is uniformly distributed inside the spherical prostate, we have derived a nomogram for Cs^{131} seeds used in prostate implant. Compared with clinical data, our nomogram shows good agreement for regular size glands. The agreement is improved in monotherapy for large size glands (30 to 60 cc).

(1). Murphy et al., Med. Phys. 31 June 2004, p1529 (2).M. Stabin et al., J. Nuc. Med. Vol. 41 January 2000, P149
(3). Kneschaurek P, et al., Med Phys. 1987 Jul; 14(4): 602-7