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INVITED LECTURE - Nuclear analytical methods in prostate cancer diagnostics

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The contents of twelve trace elements in normal (n=37), benign hypertrophic (n=43) and cancerous tissues (n=60) of the human prostate gland were investigated by instrumental neutron activation (INAA) and by radionuclide-induced (109Cd) energy dispersive X-ray fluorescent (EDXRF) analysis. The contents of Ag, Co, Cr, Fe, Hg, Rb, Sb, Sc, Se, and Zn, and of Br, Fe, Rb, Sr, and Zn were measured by INAA and EDXRF, respectively. The content of Fe, Rb, and Zn in samples was determined by two methods and mean values of the element mass fractions were quoted as a result. Mean values (M \pm SEM) for mass fraction (mg/kg, dry weight basis) in normal tissue were: Ag -0.048 ± 0.009 , Br 40.6 ± 5.6 , Co -0.045 ± 0.004 , Cr -0.53 ± 0.08 , Fe -115 ± 6 , Hg -0.056 ± 0.011 , Rb -14.4 ± 0.9 , Sb -0.045 ± 0.007 , Sc -0.029 ± 0.005 , Se -0.70 ± 0.04 , Sr 2.5 ± 0.4 , and Zn -1078 ± 113 . In our previous studies it was shown that Zn and Ca levels in prostate are almost one order of magnitude higher than in other soft tissues. The obtained means for Br and Cr mass fraction are more than two times higher than mean values of element content in skeletal muscle, liver and whole blood. So, the human prostate accumulates not only Zn and Ca, but also such trace-elements as Br and Cr. It was observed that in benign hypertrophic tissues the contents of Co, Cr, Hg, Sb, and Se were higher and the contents of Br, Fe, Rb, Sr, and Zn were equal to those in normal tissues. The contents of Co, Rb, Sc, and Zn were lower and those of Ag, Br, Cr, Fe, Hg, Sb and Sr were higher in cancerous tissues than in normal tissues. Finally, we propose to use the in vitro and in vivo estimation of Zn mass fraction in gland as an accurate tool to diagnose prostate cancer.

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