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与年龄有关的放射性核素在体内的代谢模型

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摘要 本文扼要介绍了近几年发表的与年龄有关的核素在体内的代谢模型,它是制订不同年龄公众成员内照射剂量次级标准所必需的资料。胃肠道模型显示出,未成年人员胃肠道各段质量及内容物通过速率的不同均可影响难溶性物质对胃肠道本身的剂量,只有对1周岁以下婴儿才考虑月龄对核素经胃肠道吸收分数的影响。肺模型表明,微粒在呼吸系统各部位的沉积和廓清均与年龄有一定关系。对吸入~(222)Rn、~(220)Rn子体所致气管、支气管和肺部α剂量的估算表明,以6岁儿童为最高,约为成人的3倍。已报道了氚、碘-131、铯-137、放射性锶,镭和钚等核素与年龄有关的在体内器官的代谢模型。在慢性照射条件下,可用线性方程由同一元素在成人某器官的沉积分数和生物半排期求得给定年龄人员相应的数值。可获得此类数据的元素有21个。

关键词 核素 代谢模型 年龄依赖关系

分类号

AGE-DEPENDENT METABOLIC MODEL OF RADIONUCLIDES IN HUMAN BODY

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Abstract Age--dependent metabolic model of radionuclides in human body wasintroduced briefly. These data are necessary in setting up the secondary doselimit of internal exposure of the general public. For the gastro--intestinal tractmodel, it was shown that the dose of various sections of GI tract caused byunsoluble radioactive materials were influenced by the mass of section and meanresidence time, both of which are age--dependent, but the absorption fraction f_1through GI tract should be corrected only for the infant less than 1 year of age.For the lung model, it was indicated that the fraction of deposition or clearanceof particles in the different compartments of lung were related to age. The dosesof tracheobronchial and pulmonary compartment of adult for ~(222)Rn or ~(220)Rn withtheir decay products were one third of that of 6-years old child who received themaximum dose in comparison with other ages. The age--dependent metabolic modelsin organ and/or body of Tritium, Iodine--131, Caesium--137, radioactive Strontium,Radium and Plutonium were reported. A generalized approach for estimating theeffect of age on deposition fractions and retention half--time were presented.Calculated results indicated that younger ages were characterized by increaseddeposition fraction and decreased half-time for retention. Representative exampleswere provided for 21 elements of current interest in health physics.

Key words Radionuclide Metabolic model Age-dependence

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