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Toxicologic Effects of Radon Exposure

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Radon exposure is an entity that falls within the realm of environmental toxicology. While other elements such as lead have taken the forefront in clinical screening, the issue of radon exposure is important for primary care physicians to bear in mind during the practice of medicine. Radon (Rn, atomic number 86) is a radioactive noble gas and is a natural decay product of uranium, actinium, and thorium. Radon is the heaviest noble gas and was discovered by Friedrich Ernst Dorn in 1900 at which time it was initially named radium emanation, then niton, and finally radon in 1923. Radon emits α and γ particles; and apart from being a risk to miners and others who work underground, radon can enter buildings through the building materials themselves or through microscopic cracks in a building structure causing exposure risk to inhabitants.[1] Geographic areas of the United Sates (US) that have known high levels of radon include areas of New York, New Jersey, and Pennsylvania, yet radon may be in soil formations throughout the US.

The concern for identifying radon exposure lies in the increased risk of developing bronchogenic carcinoma of the lung. The average concentration of radon in outdoor air is 0.4 picocuries per Liter (pCi/L).[2] The Environmental Protection Agency estimates that over 8 million homes have radon levels greater than 4 pCi/L.[3] The radon particles are inhaled and the resulting radioactive decay products and the subsequent exposures lead to dysplasia and possibly carcinoma. Risk of carcinoma development is compounded by cigarette smoking, not only from the carcinogens in cigarette smoke itself, but also in radon binding to the particulate matter in cigarette smoke.

Estimates of deaths from indoor radon exposure are in the thousands[4] and a pooled analysis of European studies of indoor radon exposure resulted in a relative risk (RR) of 1.08%.[5] A highly studied population group concerning radon exposure is underground miners. Several studies among uranium miners[6] and iron ore miners[7] have linked inhalation of radon particles with lung carcinoma. It has been noted that indoor radon exposures are much lower than underground mining exposures, yet the duration of exposure and large numbers of individuals exposed highlights the importance of indoor radon's contributions to

carcinogenesis.[8] One study in the United Kingdom (UK) concluded that radon was responsible for 6.5% of all deaths from lung cancer in the UK, including 5.5% from the joint affect of smoking and radon and 1% to radon alone.[9] Other reports indicate indoor radon may be responsible for up to 4.5% of lung carcinomas.[10] Numerous case studies of radon exposure performed over the past few decades have added to the scientific and clinical evidence that supports radon's role in lung carcinogenesis.

The goal of the physician and perhaps public health advocates is to make patients aware of the risks of radon, especially in high-risk geographical areas. Screening can be done by a number of methods;[11] some of the more common methods use charcoal canister devices that can be acquired through some hardware stores and state health departments, which are then analyzed by a central laboratory. Indoor radon levels can be lowered by increasing ventilation, sealing foundations, and installing air-cleaning devices.[3] Awareness of risk and assessment of possible radon exposure are the goals that physicians and public health officers can promote in preventing radon-related morbidities.

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