DESIGN, FABRICATION & EVALUATION OF A NEW CALIBRATION PHANTOM FOR *IN VIVO* MEASUREMENT OF BONE SEEKING RADIONUCLIDES

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ABSTRACT

A new anthropometric phantom has been developed for calibrating *in vivo* measurements for bone seeking radionuclides deposited in the knee. The phantom has the shape and appearance of the human adult knee and includes individual compartments for the femur, patella, tibia, and fibula. Each of these bones can be fabricated with a precisely known quantity of radioactive deposited uniformly throughout the tissue matrix or distributed on surfaces. The knee is assembled in three interlocking layers to simplify installation of each bone, enabling calibrations for different radionuclides to be performed with the same phantom. Each layer of the knee phantom is offset to avoid streaming so that one or more detectors can be positioned on the front or sides of the phantom. The phantom is fabricated using polyurethanes, $CaCO_3$, and other trace materials to produce a substitute for human tissue having the same density, μ, and Z_{eff} as that of human muscle and trabecular bone. Use of any natural human or animal bone is completely avoided. Intercomparison measurements for ^{241}Am in bone using arrays of Phoswich or germanium detectors demonstrate that the knee phantom exhibits the same detection efficiency as that for the skull. In vivo measurement of the knee is a desirable alternative to the skull for evaluating recent exposure to bone seeking radionuclides since the bones of the knee exhibit a more rapid turnover than the skull. Calibration measurements using the new knee phantom show that it is durable, easy to use, and provides consistent results over repeated measurements. The presentation will describe the fabrication of the new phantom and its use with Phoswich and germanium detector arrays at several whole body counters in the United States and Europe.

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