Purpose: A brain tissue surrogate material was needed to fill the anatomical cavity of a skull to create a phantom for use in simulated Neuro-EIGI procedures. To enable diagnostic and interventional procedure simulation, the BIM must fit into and be congruous with the interior surface of the skull, be reusable, and allow the implantation of vascular phantoms. The material must reasonably reproduce the automatic technique parameter selections observed during Neuro-EIGI procedures.

Methods: We formulated a putty-like material to be used as the BIM. Its x-ray attenuation properties were evaluated by comparison of the fluoroscopic and radiographic technique parameters automatically selected for a BIM-filled skull on a Toshiba Infinix angiographic C-arm unit to those of a solid anthropomorphic head phantom at various projection angles. The same comparison was made between the skull phantom without BIM in the cavity and the anthropomorphic head phantom. The BIM linear attenuation coefficient was calculated and compared to that of PMMA, a common tissue analog plastic.

Results: The BIM keeps its shape, is moldable and reusable, and is congruent to the skull’s interior surfaces. It allows for insertion and interchange of various custom vascular phantoms at proper anatomic locations. Addition of the BIM to the skull cavity improves the matching of the automatically selected parameters to those of the anthropomorphic phantom by an average of 96.3% for mAs and by 4.2% for kVp in fluoroscopy mode and by 88.6% and 9.0%, respectively, in DSA mode. The BIM’s experimental and theoretical linear attenuation coefficient for the RQA5 spectrum differed from PMMA’s by about 30%.

Conclusions: Despite the difference in attenuation coefficients between the PMMA and BIM, the BIM is a good surrogate material for Neuro-EIGI research as shown by its properties of congruity, reusability, and device implantation, along with the demonstrated improvement of automatically selected technique parameters.

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