Purpose: Development of an easily reproduced, fractionated whole brain irradiation technique for the study of radiation-induced cognitive impairment in nonhuman primates.

Methods: A nonhuman primate (NHP) irradiation technique has been developed that replicates the fractionated whole brain irradiation technique for humans. Right and left lateral 6MV x-ray beams are used, with opposed central axes matched at the level of the outer canthi. An eye block shields both eyes for each lateral beam. Monitor unit calculations to mid-brain are based on anatomical measurements with a mid-field slant distance incorporated. Total dose is 40 Gy, delivered at 5 Gy/fraction x 8 fractions, two fractions/week for four weeks. A clinical linear accelerator is used, with personnel procedures, room preparation, and clean-up per research animal and human care requirements.

Results: NHP positioning and beam parameter choices (eg, gantry and collimator rotation) allow for flexibility at the time of irradiation, based on anesthesia requirements and individual animal anatomy. Computed monitor units scale with NHP cranial measurements, which scale with NHP weight. A record/verify system facilitates set-up and dose recording for each animal. Each right and left lateral radiation field is delivered via image-guidance by the use of pre-irradiation electronic portal imaging to verify positioning immediately before irradiation. Portal imaging dose, also performed at 6 MV, is recorded as irradiation dose. The portal image record enables post-irradiation assessment of each fraction as well as cumulative dose. Room readiness techniques include preparations to minimize potential contamination of clinical equipment, and clean-up procedures for return of equipment to human use.

Conclusions: A simple, reproducible approach has been devised to replicate human fractionated whole brain irradiation of NHP cohorts to enable research studies of radiation-induced cognitive impairment. Our irradiation techniques and experience are reviewed for the safe and efficient irradiation of this unique animal species.

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