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The Effect of Inertial Changes on Particle Size Distribution in Nebulizer Systems: The Impact on Clinical Aerosol Studies

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Previous studies have shown that aerosol particle size plays a major role in determining the quality of aerosol images produced from a nebulized radiopharmaceutical. The purpose of the current study was to compare a standard commercially available nebulizer with two modified systems with regard to particle size distribution and quality of aerosol image production.

Methods: A standard nebulizer system was modified to reduce the percent of particles greater than 1 micron by a series of directional changes which eliminated larger particles based upon inability of these particles to change direction rapidly. The unmodified nebulizer produced 35% of particles between 1.0-5.0 microns. The first modified system produced 2.93% of particles between 1.0-5.0 microns and the third produced 8.2% of particles between 1.0-5.0 microns.

43 consecutive patients were randomized to 1 of 3 nebulizers. Images were evaluated by 2 observers blinded as to the nebulizer used. A semi-quantitative rating system was employed for 3 characteristics of the images including overall image quality, peripheral penetration and central deposition.

In all three categories, the nebulizer demonstrating the lowest percentage of particles between 1.0-5.0 microns achieved the highest rating for all 3 categories. Central deposition was almost non-existent with this nebulizer.

We conclude that inertial modification of particle size to less than 1 micron is feasible. The reduction in particle size directly contributes to the improved quality of aerosol images resulting in increased peripheral penetration, decreased central deposition, and overall image quality.

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