

# SPECT/CT Imaging in a Rabbit Model of Emphysema Reveals Ongoing Apoptosis *In Vivo*

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## Abstract

**Rationale:** Evaluation of lung disease is limited by the inability to visualize ongoing pathological processes. Molecular imaging targeting cellular processes related to disease pathogenesis has the potential to assess disease activity over time to allow intervention prior to lung destruction. Since apoptosis is a critical component of lung damage in emphysema, a functional imaging approach was taken to determine if targeting apoptosis in a smoke exposure model would allow the quantification of early lung damage *in vivo*. **Methods:** Rabbits were exposed to cigarette smoke for 4- or 16-weeks and underwent SPECT/CT scanning utilizing <sup>99m</sup>Tc-Annexin V. Imaging results were correlated with *ex vivo* tissue analysis to validate the presence of lung destruction and apoptosis. **Results:** Lung CTs of long term smoke-exposed rabbits exhibit anatomical similarities to human emphysema, with increased lung volumes compared to controls. Morphometry on lung tissue confirmed increased mean linear intercept and destructive index at 16 weeks of smoke exposure and compliance measurements documented physiological changes of emphysema. Tissue and lavage analysis displayed the hallmarks of smoke exposure including increased tissue cellularity and protease activity. <sup>99m</sup>Tc-Annexin V SPECT signal was increased following smoke exposure at 4- and 16-weeks, with confirmation of increased apoptosis through TUNEL staining and increased tissue neutral sphingomyelinase activity in the tissue. **Conclusions:** These studies not only describe a novel emphysema model for use with future therapeutic applications, but most importantly characterize a promising imaging modality that identifies ongoing destructive cellular processes within the lung.

**KEYWORDS:** [Emphysema](#), [Smoke](#), [Apoptosis](#), [Molecular Imaging](#)

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