

Clinical studies of alveolar-capillary permeability using technetium-99m DTPA aerosol

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Soluble radioaerosols such as technetium-99m diethylene triamine pentacetate (DTPA) permit simple quantitative studies of alveolar-capillary permeability to be performed, since the submicronic aerosols are deposited mainly at the lung periphery and are cleared across the alveolar-capillary membrane. Regional alterations in permeability can also be noted using this radionuclide technique. We have measured the pulmonary epithelial permeability in normal subjects and the alteration in smokers, in glue-sniffers, in patients with inhalation burns, in chronic obstructive pulmonary disease (COPD) and in patients with lung metastases from thyroid cancer treated with radioiodine ^{131}I . In the normal volunteers, the time taken for 50% of inhaled $^{99\text{m}}\text{Tc}$ DTPA to be cleared from the lungs ($T_{1/2}$) was 66 minutes \pm 1sd of 12 mins. The smokers had a mean $T_{1/2}$ of 20 mins \pm 1sd 4 min. In the hard-core glue-sniffing group, the majority were smokers who had stopped smoking and glue-sniffing for periods varying from 1 day to 42 days, and it was possible to note the changes in clearance times against period of abstinence.

In the patients with inhalation burns, there was change in lung clearance arising from pulmonary epithelial damage; these patients showed increased rate of clearance (short $T_{1/2}$) with mean $T_{1/2}$ of 36 min \pm 1sd of 11 mins, while the retention images revealed regional lung damage in moderately severe inhalation burns. Twenty-four patients with COPD had inhalation scans done with Tc-99m tin colloid radioaerosol, and these images were compared with the perfusion lung scans done with $^{99\text{m}}\text{Tc}$ macroaggregated albumin (MAA); in general the perfusion images matched the defects noted in the inhalation scans. The $^{99\text{m}}\text{Tc}$ DTPA clearance rate in these patients was normal i.e. $T_{1/2} = 78 \pm 14$ mins. In the thyroid cancer patients with lung metastases, who had high doses of radioiodine treatment, the $T_{1/2}$ values were normal or prolonged slightly, mean $T_{1/2} = 76$ min \pm 23.

Key words: alveolar-capillary permeability, inhalation burns, COPD (chronic obstructive pulmonary disease), glue sniffers, thyroid cancer lung metastases