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A PILOT RADIOLOGIC-PHYSIOLOGICAL CORRELATIVE STUDY OF SILICOSIS PATIENTS USING THREE DIMENSIONAL COMPUTED TOMOGRAPH (3D-CT) LUNG VOLUMETRY

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AIMS: (1) To research the feasibility of performing these scans

(2) To determine preliminary correlations between 3D lung volumes with volumes obtained at lung function testing.

METHODS: Non-enhanced volumetric 7mm collimated sections with 3.5mm interslice interval from lung apex to base in full inspiration and expiration were performed on 20 known silicosis patients. Volumetric data were transferred to a graphics workstation (Windows Advantage; GE Medical Systems) and 3D models reconstructed by applying threshold limits to the data set to obtain inspiratory total lung capacity (3D-TLC), emphysema volume (3D EV), and residual volume (3D-RV). Threshold values were also applied to selected axial CT scans to quantitate nodular profusion (profusion index), and emphysema (emphysema grade). Visual qualitative scores of emphysema (emphysema grade) were also obtained. Intercorrelations between these scores and 3D-CT lung volumes with lung function indices and spirometry were evaluated.

RESULTS: Preliminary results showed good correlations between 3D-TLC and TLC ($p=0.0003$, $r=0.68$); 3D-EV and FEV₁ ($p=0.019$, $r=-0.463$); 3D-EV and FEV₁/FVC ($p=0.026$, $r=-0.444$); 3D-EV and RV, ($p=0.03$, $r=0.44$); and 3D-EV and emphysema grade ($p=0.000$, $r=0.735$). There were also correlations between profusion index and PMF grade ($p=0.01$, $r=0.555$); profusion index and FEV₁ ($p=0.025$, $r=0.499$); and between emphysema grade and FEV₁/FVC ($p=0.0004$, $r=-0.791$).

CONCLUSION: These preliminary results validate quantitative CT and 3D-CT lung volumetry as useful techniques in the evaluation of silicosis, with good physiological correlation. These techniques can also be applied particularly in the assessment of patients with chronic obstructive pulmonary disease and emphysema.

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ADHERENCE OF PSEUDOMONAS AERUGINOSA TO BASEMENT MEMBRANE COLLAGEN IN VITRO

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Pseudomonas aeruginosa (PA) is a virulent and versatile Gram -ve bacilli which chronically infects and colonizes the tracheobronchial tree of patients with bronchiectasis. The mechanisms for PA to persist in the airways are unclear although there is increasing evidence to suggest that adherence to damaged cells and basement membrane is an important mechanism for its persistence in bronchiectatic airways. We have therefore developed an in vitro model to study PA adherence to human basement membrane collagen (type IV) by using scanning electron microscopy (SEM), and have applied this to study the effects of collagen components, Ca²⁺, lectins, and heparin on PA adherence. PA adherence density was determined as the ratio of the number of PA bacilli/20 SEM fields (4000x) to log inoculum size after incubation in 37°C for 45 min. PA was cultured overnight in brain heart infusion containing EM before adherence experiments. In absence of heparin (n=8), PA adherence density was 28.6 units which was significantly ($p<0.05$) higher than in the presence of 10, 100 and 1000 U/ml whose adherence densities were 13.4, 13.8, and 16.1 units respectively. The presence of 0.01, 0.1 and 1 mg/ml PHA-E (n=6) had adherence densities of 31.6, 24.8, *10.8, *18.4 units respectively. The presence of Ca²⁺ (n=12) at 0, 5, 10, and 15 mM had adherence densities of 34.1, *18.9, 29.9, 36.1 units. PA adherence density was not affected significantly in the presence of proline, tan-hydroxyl-proline, glycine, galactose, N-acetyl-neuraminic acid, N-acetyl-glycosamine or *Arachis hypogea* ($p>0.05$). Our results show significant effects of Ca²⁺, heparin, and PHA-E in PA adherence to collagen and might lead to the development of novel therapy for PA infections.

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