

The assessment of short and long term changes in lung function in CF using ^{129}Xe MRI

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Online Supplementary Material

Methods

^{129}Xe ventilation MRI was performed on a 1.5T GE HDX MRI scanner (GE Milwaukee, USA). Images were acquired at a lung volume of end-inspiratory tidal volume as previously described, using titrated inhaled volumes of test gas (1). The test gas comprised of ^{129}Xe and N_2 . To achieve this end-inspiratory lung volume whilst in the scanner, patients were coached to initially breathe tidally by a trained operator. Once a stable breathing pattern was observed the test bag of gas was administered when the patient was at a lung volume of functional residual capacity. The volume of the test bag was titrated based on the standing height of the patient, details of which can be found in Table 1 below. 129-enriched (86%) ^{129}Xe was hyperpolarised to $\sim 30\%$.(2)

Table 1 - Inhaled bag volumes and the gas doses for ^{129}Xe at each height range.

Patient Height	Total Bag Volume	^{129}Xe and N_2 Gas dose
160cm +	1.0 L	500 ml ^{129}Xe + 500 ml N_2
150-160cm	800 ml	450 ml ^{129}Xe + 350 ml N_2
140-150cm	650 ml	400 ml ^{129}Xe + 250 ml N_2
130-140cm	500 ml	350 ml ^{129}Xe + 150 ml N_2
120-130cm	400 ml	300 ml ^{129}Xe + 100 ml N_2

^{129}Xe ventilation MRI was performed using a transmit-receive vest coil (Clinical MR Solutions, Brookfield, USA) and a 3D ventilation imaging sequences were used as described previously (3). For ^{129}Xe acquisition: a bSSFP 3D sequence was used, with bandwidth = 16kHz, TE/TR = 2.2/6.7ms, flip angle = 10° .

In order to calculate the ventilation defect percentage (VDP) from ^{129}Xe images, a separate ^1H anatomical image was acquired in order to calculate the thoracic cavity volume. ^1H images were acquired with the same breathing sequence as for ^{129}Xe MRI, using a volume of air equivalent to the volume used for ^{129}Xe MRI. For ^{129}Xe , the ^1H images were acquired during a separate breath-hold immediately prior to the ^{129}Xe image. This then required an additional automated registration of the ^1H images to the ^{129}Xe images using MATLAB (Mathworks, Natick, MA) to get accurate alignment for image segmentation.

References

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