

Vibration Response Imaging (VRI) of the Lung in Healthy Japanese Men

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Rationale: VRI uses sensors to record energy generated by vibrations of the lungs during respiration and creates an image that can be viewed dynamically or as sequential frames. Our objective was to characterize the standard VRI in healthy Japanese men.

Methods: 41 normal Japanese males (age 33.0±7.0yrs; 20 non-smokers, 5 ex-smokers, 16 current smokers) were recorded. Subjects were defined as healthy according to medical history, lung function test and physical exam. The percentage contribution of each lung to the total vibration signal (relative regional assessment, RRA) was automatically calculated. We defined the darkest part of each lung in every frame as the maximal energy point (MEP). We assessed movement of MEP in each lung during the breathing cycle and the difference in the timing of energy development between both lungs.

Results: The average RRA of the right lungs was 48.3±5.1% and left lung was 51.7±5.1% ($p<0.05$). A subgroup analysis showed that this pattern changed when RRA values were calculated for the 21 subjects with a smoking history; there was no significant difference between right and left values in this group (49.9±4.6% vs. 50.1±4.6%). The images evolved centrally and developed vertically in a smooth, coordinated fashion. Bottom-to-top movement of MEP was observed in 29.3% of subjects; top-to-bottom movement was observed only in 2.4%. Generally, the movement of vibration energy on both the left and right sides was synchronous, but 9.6% cases had $\geq 20\%$ of total inspiratory time difference in the timing of maximal energy development between both lungs.

Conclusions: Distribution of vibration energy shows characteristic patterns that define a normal range of VRI images in Japanese males. Vibration energy is predictably greater in the left lung and develops in a synchronous manner. These patterns are altered by cigarette smoking.