Machine learning classifier models to identify ARDS patients with a low percentage of potentially recruitable lung

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Introduction

The knowledge of the percentage of potentially recruitable lung, *i.e.* the proportion of the lung that can be re-aerated from 5 to 45 cmH_2O of airway pressures, is important to establish the therapeutic efficacy of PEEP in ARDS patients. The amount of the potentially recruitable lung is based on the acquisition of two CT scans at both end-inspiration and end-expiration holds and on the quantitative analysis of the CT scans. However, the X-ray exposure must be carefully evaluated.

Aim of the study

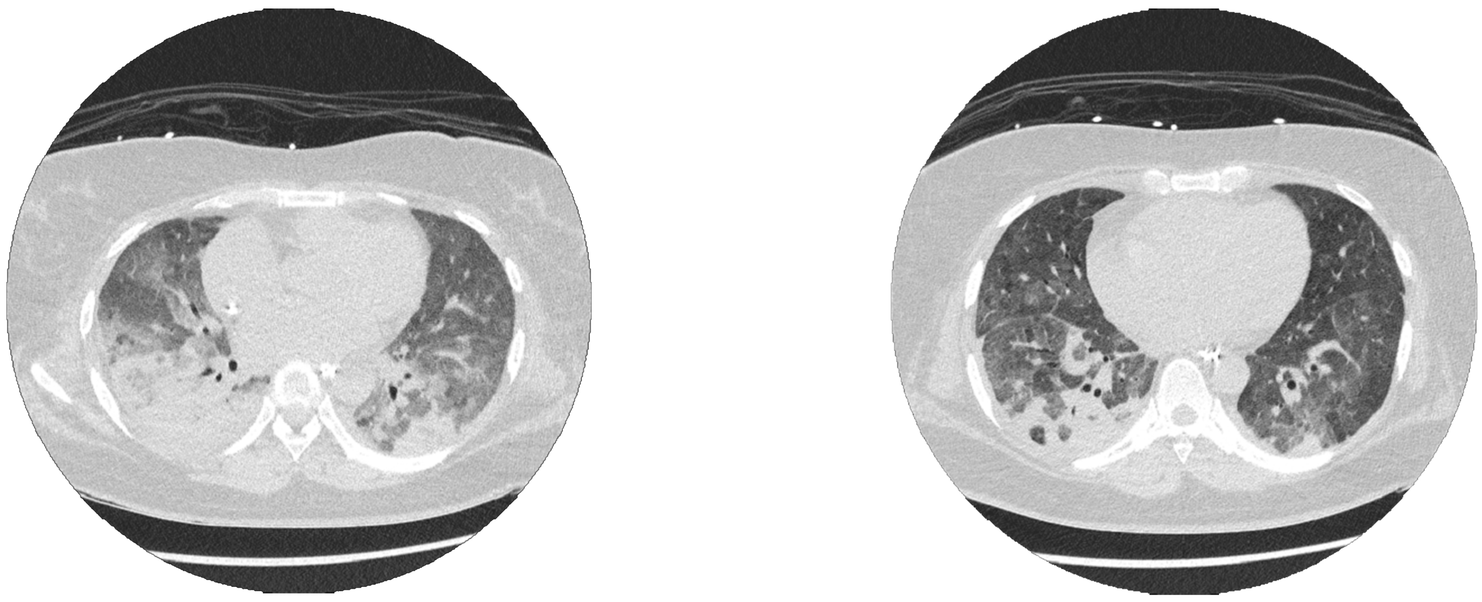
Our work aimed to build machine learning models able to classify patients with a low percentage of potentially recruitable lung (<10%), using clinical data, including lung mechanics parameters and gas exchange, and/or the data from an end-expiratory CT scan, to reduce radiation exposure.

Material and Methods

Lung CT scans at airway pressures of 5 and 45 cmH2O of 221 ARDS patients were retrospectively collected. A random forest algorithm with a 10-fold cross validation was used to build three classification models based on measures of 1) clinical data, including measures of lung mechanics and gas exchange, 2) end-expiratory CT scan and 3) clinical data and end-expiratory CT combined. Data were randomly split into a train/validation set (80%) and a test set (20%), to evaluate the performance of the model on unseen data.

Results

The areas under the ROC curve of the three models in the test set was 0.67, 0.71, 0.81, respectively. Accordingly, the sensitivities were 0.80, 0.85, 0.84, while the specificities were 0.53, 0.58, 0.79.



Example of lung CT scan at 5 (left) and 45 cmH_2O (right)

Conclusions

Machine learning model is a reliable tool to identify patients with a low percentage of potentially recruitable lung, thus it could provide clinical decision support in the ventilatory management of ARDS patients, preventing ventilator-induced lung injury while reducing radiation exposure.

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