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Clinical Imaging 79 (2021) 96–101

Contents lists available at ScienceDirect

Clinical Imaging

journal homepage: www.elsevier.com/locate/clinimag

Cardiothoracic Imaging

Automated quantitative thin slice volumetric low dose CT analysis predicts disease severity in COVID-19 patients

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ARTICLE INFO

Keywords:
COVID-19 pneumonia
Low dose volumetric CT
CT analysis

ABSTRACT

Purpose: This study aimed to identify predictive (bio-)markers for COVID-19 severity derived from automated quantitative thin slice low dose volumetric CT analysis, clinical chemistry and lung function testing.
Methods: Seventy-four COVID-19 patients admitted between March 16th and June 3rd 2020 to the Asklepios Lung Clinic Munich-Gauting, Germany, were included in the study. Patients were categorized in a non-severe group including patients hospitalized on general wards only and in a severe group including patients requiring intensive care treatment. Fully automated quantification of CT scans was performed via IMBIO CT Lung Texture analysis™ software. Predictive biomarkers were assessed with receiver-operator-curve and likelihood analysis.
Results: Fifty-five patients (44% female) presented with non-severe COVID-19 and 19 patients (32% female) with severe disease. Five fatalities were reported in the severe group. Accurate automated CT analysis was possible with 61 CTs (82%). Disease severity was linked to lower residual normal lung (72.5% vs 87%, $p = 0.003$), increased ground glass opacities (GGO) (8% vs 5%, $p = 0.031$) and increased reticular pattern (8% vs 2%, $p = 0.025$). Disease severity was associated with advanced age (76 vs 59 years, $p = 0.001$) and elevated serum C-reactive protein (CRP, 92.2 vs 36.3 mg/L, $p < 0.001$), lactate dehydrogenase (LDH, 485 vs 268 IU/L, $p < 0.001$) and oxygen supplementation ($p < 0.001$) upon admission. Predictive risk factors for the development of severe COVID-19 were oxygen supplementation, LDH >313 IU/L, CRP >71 mg/L, <70% normal lung texture, >12.5% GGO and >4.5% reticular pattern.
Conclusion: Automated low dose CT analysis upon admission might be a useful tool to predict COVID-19 severity in patients.

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https://doi.org/10.1016/j.clinimag.2021.04.008
Received 14 December 2020; Received in revised form 7 March 2021; Accepted 8 April 2021
Available online 21 April 2021
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