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Corticosteroid therapy is associated with a decrease in mortality in a multicenter cohort of mechanically ventilated COVID-19 patients

B. Lambermont¹; M. Ernst²; P. Demaret³; V. Fraipont⁴; C. Gurdebeke⁵; T. Sottiaux⁶; M. Quinonez⁷; C. Dubois³; T. Njambou⁸; B. Akando⁹; T. Lemineur¹⁰; D. Wertz¹¹; F. Forêt¹²; AF. Rousseau¹; D. Ledoux¹; N. Layios¹;

S. Robinet¹; P. Morimont¹; B. Misset¹

¹Department of intensive care, University Hospital Liege, Liège, Belgium; ²Biostatistics and medico-economic department, University Hospital Liege, Liège, Belgium; ³Department of anesthesia and intensive care., MontLegia Hospital - Groupe Santé CHC, Liège, Belgium; ⁴Department of intensive care, CHR de la Citadelle, Liège, Belgium; ⁵Department of intensive care, CHR Verviers, Verviers, Belgium; ⁶Department of intensive care, Clinique Notre-Dame de Grace, Gosselies, Belgium; ⁷Department of intensive care, Hospital Center Bois De L'abbaye, Seraing, Belgium; ⁸Department of intensive care, Hospital Center Reine Astrid, Malmedy, Belgium; ⁹Department of intensive care, Hospital Saint-Joseph Saint-Vith, Sankt Vith, Belgium; ¹⁰Department of intensive care, Clinical André Renard, Herstal, Belgium; ¹¹Department of intensive care, Hos-pital Center Régional De Huy, Huy, Belgium; ¹²Department of intensive care, Chu Ucl Namur - Site De Dinant, Dinant, Belgium

Correspondence: B. Lambermont

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Introduction: In late 2019, the virus responsible for Covid-19 was identified and called SARS-CoV-2. In China, 5% of Covid-19 patients were admitted in ICU, 2,3% were ventilated and 1,4% died. In early 2020, Covid-19 quickly spread in Europe and was responsible for high mortality. Since the start of the SARS-CoV-2 pandemic, the need for trials to assess the benefit of antiviral treatment, anti-cytokine drugs, convalescent plasma and hydroxychloroquine has been advocated by the world health organization. However, evidence of the efficacy of such strategies is still lacking.

Objectives: This observational multicentric study aimed to identify prognostic factors and therapies which could be valuable in mechanically ventilated Covid-19 patients for respiratory insufficiency.

Methods: The method consisted in a multicentric retrospective analysis in all consecutive Covid-19 patients admitted to intensive care unit (ICU) and mechanically ventilated for more than 24 hours from March 1 to April 25, 2020, in 12 hospitals. The study protocol was approved by our Ethics Committee and, due to the retrospective nature of the data collected, no consent from the patient was required.

Admission date, age, sex, body mass index, underlying conditions, treatments, physiological values, use of vasopressors, renal replacement therapy (RRT) and extracorporeal membrane oxygenation (ECMO), duration of mechanical ventilation, length of ICU stay, ICU and ventilator-free days at day 42 were collected during May 2020. A second call for missing data was done during June 2020 in each center. The primary outcome was survival during the hospital stay. Secondary outcomes included use of vasopressors, RRT or ECMO, ICU and ventilator-free days at day 42, and evolution of the main physiological values between days 0 and 7. Quantitative variables were reported as median and interquartile range (Q1-Q3). Categorical variables were expressed as number (%). Simple and multiple time-dependent Cox regression models were used to assess the effects of factors on survival. All the variables which had a p-value lower than the critical level of 0.1 were selected for the multivariate model. A p-value < 0.05 was considered significant.

Results: From March 1 to April 25, 2020, out of 2003 adult patients hospitalized for SARS-CoV-2 pneumonia, 361 were admitted to the 12 participating ICUs for acute respiratory failure. Of these, 257 patients were ventilated for more than 24 hours and 247 were included in the data base. The median age of the 247 patients was 65 (57-72), and 172 (70%) were men. On admission, the median sequential organ failure assessment (SOFA) score was 6 (4-8), the median PaO₂/FiO₂ ratio was 103 (82-132) and 128 (52%) patients were treated with norepinephrin. The median length of stay in ICU was 21 (12-32) days, the median survival time was 82 days, and the mortality rate was 45%. Sixty-nine (28%) patients needed RRT and 215 patients (87%) were treated with norepinephrine during their ICU stay. Four patients (1,6%) were on ECMO. Corticosteroid therapy was started in 58 (23%) patients between days 0 and 7 of ICU admission and 225 (91%) patients received hydroxychloroquine alone or in combination with corticosteroid and/or azythromycin. The mortality rate of the patients who received corticosteroid was 34% (20/58) while it was 48% (91/189) for patients who did not (p = 0,01).

As opposed to survivors, non-survivors were older and suffered more often from chronic kidney disease. On admission in ICU, non-survivors had higher SOFA score and serum creatinine value, lower mean arterial pressure and diuresis. Non-survivors were also more often treated with norepinephrine during the first day in ICU. Survivors received more frequently corticosteroid and hydroxychloroquine.

Using multiple regression, the predictors of mortality were age, creatinine value, mean arterial pressure lower than 70 mmHg, lymphocytes count on day 0 and absence of corticosteroid use during the first week of mechanical ventilation. Survival probability was significantly higher in patients who received corticosteroid (p = 0,01). Survival probability was 75% by day 23 for patients who received corticosteroid versus by day 10 for those who did not.

Conclusion: Retrospectively analyzing the data of a multicenter cohort, we observed that mortality of patients with SARS-CoV-2 pneumoniatreated with mechanical ventilation was as high as 45% and median survival time was 82 days. In this series, the risk factors for mortality included age, renal and circulatory dysfunction, lymphopenia and the absence of corticosteroid use during the first week of mechanical ventilation. Corticosteroid therapy during the first week of mechanical ventilation was associated with a lower mortality (34% vs 48%) (p = 0,01).

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Artificial Intelligence to predict mortality in critically ill COVID-19 patients: a case study using Data from Lombardy outbreak

G. Angelotti¹; PF. Caruso¹; N. Stomeo¹; C. Ciccone¹; A. Zanella²; M. Greco¹; G. Grasselli³; M. Cecconi⁴

¹Anesthesia and intensive care, Humanitas Research Hospital, Milano, Italy; ²Department of anesthesiology, Fondazione IRCCS Ca'Granda Ospedale Maggiore Policlinico, Milano, Italy; ³Intensive care unit, Policlinico of Milan, Milano, Italy; ⁴Anesthesia and intensive care, Humanitas Research Hospital, Milan, Italy

Correspondence: P.F. Caruso

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Introduction: In mid-February 2020, an outbreak of atypical pneumonia caused by Severe Acute Respiratory Syndrome CoronaVirus 2 (SARS-CoV-2) represented the beginning of COVID-19 epidemic in Italy. Since then, the number of admissions in intensive care units (ICU) due to bilateral pneumonias progressing to Acute Respiratory Syndrome (ARDS) rose substantially. Lombardy, due to the high number of cases, created a network called 'COVID-19 Lombardy ICU Network' to manage the exponential surge of patients. With all the Data gathered in these patients, we hypothesized that machine learning models could predict the mortality risk in these patients.

Objectives: Predicting mortality at 7, 14 and 28 days from ICU admission in COVID-19 patients using machine learning models.

Methods: Data comprises medications, comorbidities and daily ventilation of 1503 ICU patients from Lombardy affected by COVID-19 during the early phase of the epidemic.

Two machine learning models where built: the first machine learning model was trained only with features available before ICU admission to investigate the predictive power of pre-existing conditions; the second one was integrated with all the data available during the first day of admission in ICU.

Results: The majority (51%) of the cohort faced death; survivors were characterized by significantly lower age, higher length of stay and a minor number of comorbidities at admission. Kaplan-Meier curves reveal a survival percentage drop of 30% within the first 10 days, 45% after 20 days and reaches a plateau around day 30 where the population is halved. As age increases, the percentage of survivors decreases, with lowest survival in the age cohort between 80 and 90.

Best model performance was reached when predicting mortality at 28 days, where average area under the curve (AUC) after multiple