Viral dynamics in mild and severe cases of COVID-19

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Coronavirus disease 2019 (COVID-19) is a new pandemic disease. We previously reported that the viral load of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) peaks within the first week of disease onset.[1,2] Findings from Feb, 2020, indicated that the clinical spectrum of this disease can be very heterogeneous.[3] Here, we report the viral RNA shedding patterns observed in patients with mild and severe COVID-19.

76 patients admitted to the First Affiliated Hospital of Nanchang University (Nanchang, China) from Jan 21 to Feb 4, 2020, were included in the study. All patients were confirmed to have COVID-19 at the time of admission by RT-PCR. The viral loads of their nasopharyngeal swab samples were estimated with the ΔCt method ($Ct_{sample} - Ct_{ref}$). Patients who had any of the following features at the time of, or after, admission were classified as severe cases: (1) respiratory distress (≥30 breaths per min); (2) oxygen saturation at rest ≤93%; (3) ratio of partial pressure of arterial oxygen to fractional concentration of oxygen inspired air ≤300 mm Hg; or (4) severe disease complications (eg, respiratory failure, requirement of mechanical ventilation, septic shock, or non-respiratory organ failure). 46 (61%) individuals were classified as mild cases and 30 (39%) were classified as severe cases. The basic demographic data and initial clinical symptoms of these patients are shown in the appendix. Parameters did not differ significantly between the groups, except that patients in the severe group were significantly older than those in the mild group, as expected.[4] No patient died from the infection. 23 (77%) of 30 severe cases received intensive care unit (ICU) treatment, whereas none of the mild cases required ICU treatment.

We noted that the ΔCt values of severe cases were significantly lower than those of mild cases at the time of admission (appendix). Nasopharyngeal swabs from both the left and right nasal cavities of the same patient were kept in a sample collection tube containing 3 mL of standard viral transport medium. All samples were collected according to WHO guidelines.[5] The mean viral load of severe cases was around 60 times higher than that of mild cases, suggesting that higher viral loads might be associated with severe clinical outcomes. We further stratified these data according to the day of disease onset at the time of sampling. The ΔCt values of severe cases remained significantly lower for the first 12 days after onset than those of corresponding mild cases (figure A). We also studied serial samples from 21 mild and ten severe cases (figure B). Mild cases were found to have an early viral clearance, with 90% of these patients repeatedly testing negative on RT-PCR by day 10 post-onset. By contrast, all severe cases still tested positive at or beyond day 10 post-onset. Overall, our data indicate that, similar to SARS in 2002–03,[6]

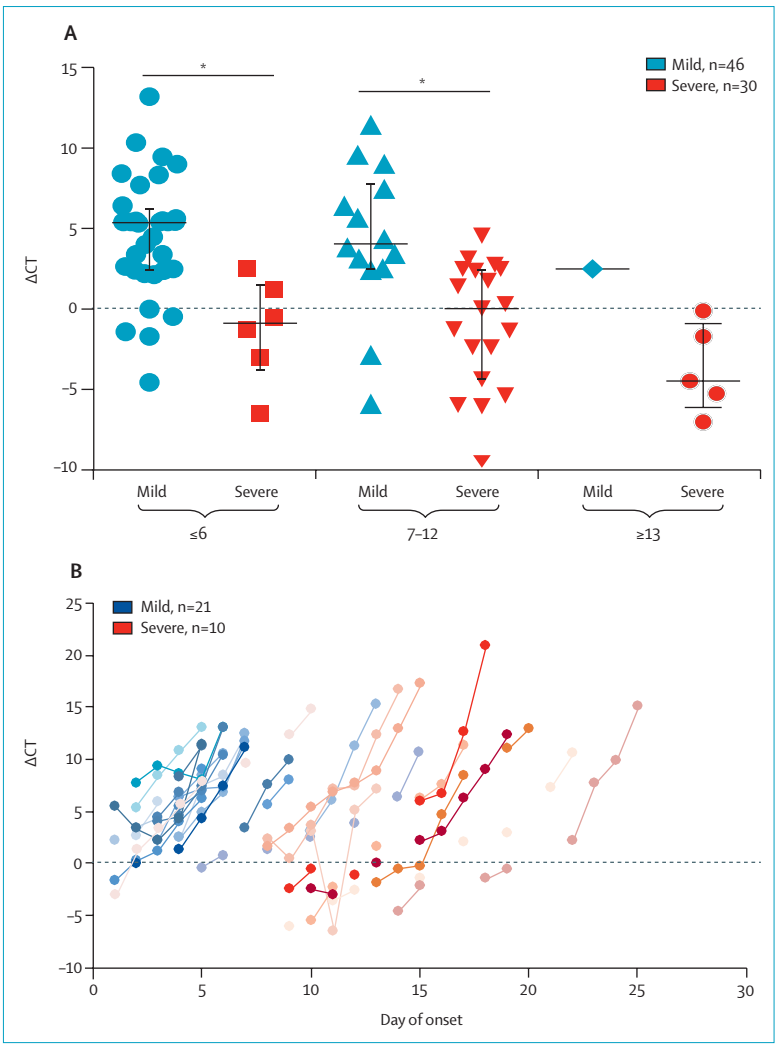

Figure: **Viral dynamics in patients with mild and severe COVID-19**
(A) ΔCT values (Ct_{sample}-Ct_{ref}) from patients with mild and severe COVID-19 at different stages of disease onset. Median, quartile 1, and quartile 3 are shown. (B) ΔCT values of serial samples from patients with mild and severe COVID-19. COVID-19=coronavirus disease 2019. *p<0·005.

See Online for appendix

patients with severe COVID-19 tend to have a high viral load and a long virus-shedding period. This finding suggests that the viral load of SARS-CoV-2 might be a useful marker for assessing disease severity and prognosis.

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