Title of the paper: COVID-19 in fully vaccinated Everest trekkers in Nepal

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Highlight

COVID-19 in a fully mRNA-1273 vaccinated aspiring Everest summiteer and an Everest trekker who had two doses of ChAdOx1nCoV-19 are presented. Delta B.1.617.2 variant was sequenced in one of the cases. Travellers should be wary of starting up travel to under-vaccinated regions, particularly if they are at high risk for severe disease.

Keywords: AstraZeneca vaccine; B.1.617.2; ChAdOx-1 vaccine; COVID-19; delta variant; mRNA-1273; SARS-CoV-2

Mount Everest (8848.46 m) attracts trekkers and mountaineers[1] who may be immunized with different COVID-19 vaccines. Among fourteen COVID-19 positive Everest travellers presenting to CIWEC in 2021, five had double doses vaccination with ChAdOx1 nCoV-19 (n=2), Sinopharm (n=1), Sputnik V (n=1) and mRNA-1273 (n=1), and one had single dose of ChAdOx1 nCoV-19. Among these, three required hospital admission while three were treated as outpatients and no mortality was reported. We present two COVID-19 cases, one with severe pneumonia and another with sequenced Delta variant, despite two doses of vaccination.

Case 1:

A 59-year-old Caucasian American male with Glucose-6-Phosphate-Dehydrogenase (G6PD) deficiency had received ChAdOx1 nCoV-19 vaccines on February 14 and April 20, 2021. He presented to CIWEC on May 9, 2021 having completed his trek in the Everest area up to 5500 m with cough, shortness of breath, diarrhoea, fatigue, and fevers for six days. On admission, he was febrile at 39°C, pulse 108/min, with oxygen saturation of 86% in room air that declined rapidly. He had crepitations over bilateral lung fields. Chest x-ray showed COVID-19 pneumonia (Figure 1). Reverse transcription polymerase chain reaction (RT-PCR) and BioFire tests from nasopharyngeal and oropharyngeal swabs were positive. He required oxygen via high flow nasal cannula (HFNC) followed by Venturi mask due to HFNC intolerance. He received monoclonal antibody cocktail of Bamlanivimab and Etesevimab (personally acquired), Remdesivir, Dexamethasone, low molecular weight heparin (LMWH), antibiotics, and paracetamol. After nine days, he had an oxygen saturation of 94-95% in room air. The d-dimer was high at 16000 ng/ml initially and stayed high till discharge. Doppler bilateral lower limbs showed acute thrombus in the right calf muscular vein. LMWH was continued at discharge followed by oral Rivaroxaban for three months. He was asymptomatic with normal d-dimer during follow up on June 17.

Case 2:

A 61-year-old Caucasian American hypertensive male, aspiring Everest summiteer, with history of mRNA-1273 vaccinations on January 12 and February 8, 2021, in the United States presented to CIWEC on May 12, 2021 after helicopter evacuation from Everest Base Camp with headache and runny nose for one day. His COVID-19 antigen test and RT-PCR were positive. Vitals and systemic examination were normal apart from nasal and throat congestion. He was discharged for hotel self-isolation. He did well and flew back home on May 25, 2021 after testing negative. Whole genomic sequencing (Allpex Seegene Covid Multiplex Screening Assay) done at Intrepid Nepal laboratory in Kathmandu showed the Delta variant B.1.617.2.

Discussion

Rapid whole-genome sequencing in vaccine breakthrough SARS-CoV-2 infections may identify new variants necessary for swift containment.[2] Sequencing was unachievable in the first trekker owing to negative RT-PCR when swabs were sent for sequencing. Preliminary data suggest the efficacy of ChAdOx1 two doses reduced from 66.1% with B.1.1.7 to 59.8% with B.1.617.2.[3] Neutralizing antibody titers (NAbs) were reduced against Delta variant B.1.617.2 relative to Wild-type and B.1.1.7 after two doses of BNT16272 vaccine.[4] Effectiveness reached 89.5% against B.1.1.7 and 75.0% against B.1.351 ≥14 days after the second dose of BNT162b2 vaccine.[5] Studies are lacking regarding the efficacy of the mRNA-1273 vaccine to the Delta variant.

Trekking exposes travellers to tight indoor quarters where social distancing cannot be maintained, and respiratory infections can spread rapidly.[6] Cold temperatures drive people

indoors into the one heated space in a lodge. Immunization should be prioritized for guides, porters, lodge owners who are the potential source and reservoir of infections. When pandemic is overwhelming the health care system, care may not always be sufficient for sick travellers to remote regions. These two cases highlight that travellers and mountaineers, even if fully vaccinated, may need to avoid countries or areas where the pandemic is at its peak or where there is a high infection risk or where new variants of concerns are circulating which may be immune escaping and associated with lower vaccine effectiveness.

Author contributions

The concept and design of this study were performed by B.A., P.P. and S.D. Data collection was done by B.A, S.D. and S.M. Data analysis was done by B.A. The manuscript was prepared by B.A. and critically appraised and edited by P.P. and S.D. and S.M. All authors agreed and approved the final manuscript.

Consent: Consent from the patients were taken and the original consents are attached with the respective patient charts.

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Figure Legends:

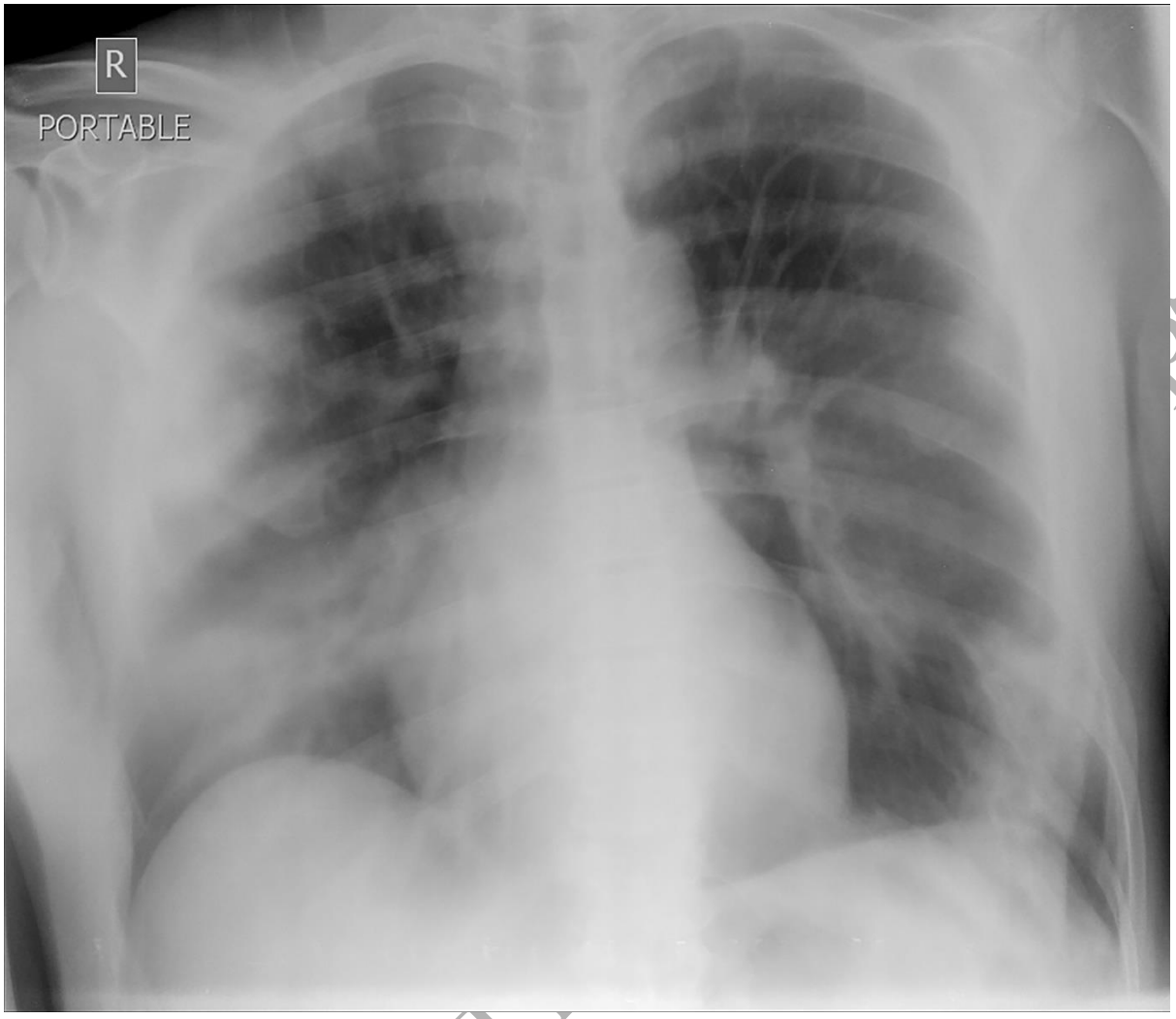

Figure 1. Initial Chest X-Ray of Case 1 showing ground-glass opacities and consolidation in the right lung peripherally in all zones with some in middle and lower zones, suggestive of COVID-19 pneumonia.