CHEST CLINIC

Periodic breathing during hypoxia altitude simulation test

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A 79-year-old slender female patient presented at the pulmonary function laboratory to perform a hypoxia altitude simulation test (HAST). It was indicated on the basis of her intention to travel by plane and a diagnosis of idiopathic pulmonary fibrosis (IPF). She was a former smoker and had a history of arterial hypertension. Her only symptoms were mMRC grade 2 dyspnoea and cough.

The test was performed at sea level through a tightly fitting facemask, attached to a pneumotachograph and a two-way non-rebreathing valve. Dead space of the circuit was 120 mL. Airflow, heart rate, inspired oxygen and carbon dioxide fraction were continuously recorded. Pulse oximetry (SpO_2) was recorded trough a finger probe (Massimo Radical 7, California, USA). In the sitting position, the patient breathed ambient air (inspired oxygen percentage=21%) for 5 min. Then, the circuit was switched to a reservoir filled with a gas mixture containing 15.1% oxygen, equivalent to a barometric pressure of 75.3 kPA (565 mm Hg) or an altitude of 8000 feet (2440 m) above sea level, for 20 min. A final 5 min recovery period breathing ambient air was also recorded.[1]

The initial phase showed all parameters within normal values (SpO_2 97%, heart rate 70 beats/min). At 4 min and 30 s into the hypoxic phase, periodic breathing began; oximetry at that time was 94%. Figure 1 shows test signals from a representative segment of the record, with alternating periods of apnoea and hyperpnoea, lasting 30–40 s, accompanied by subsequent oscillations in pulse oximetry and heart rate. Lag between ventilation and changes in oximetry can be clearly appreciated (red arrows). Her lowest SpO_2 was 87%. The patient remained awake and asymptomatic during the whole test (Borg dyspnoea scale=0).

Periodic breathing has been described in several diseases, and associated with altitude exposure.[2] It has been attributed to uncoupling between central control of ventilation and circulatory feedback of changes in ventilation. It can be triggered by hypoxaemia and hypocapnia occurring during sleep, altitude exposure, stroke, heart failure[3] and interstitial lung disease.[4] This phenomenon has previously been described in hypobaric hypoxia during exercise[5] and sleep[6] and, experimentally, in normobaric hypoxia in healthy young adults and athletes.[7 8]

Guidelines indicate supplemental oxygen if there is a fall in SpO_2 below 85% or the use of continuous positive airway pressure (CPAP) devices in patients with already diagnosed sleep disturbances requiring them.[1] But it does not give any indication on how to manage a patient with SpO_2 above that threshold presenting with periodic breathing. In a recent report of patients with obstructive sleep apnoea related to IPF, oxygen rather than CPAP was more effective for treating periodic breathing.[4]

The present report pictures periodic breathing during a diagnostic normobaric HAST at rest in an IPF patient. This finding could predict its manifestation during a commercial flight, where we found no data on its occurrence. Although probably not crucial in short flights, periodic breathing could be a distressful experience during flights spanning several hours. Therefore, it could be wise to indicate in-flight oxygen when this breathing pattern is diagnosed, especially in long-haul flights.

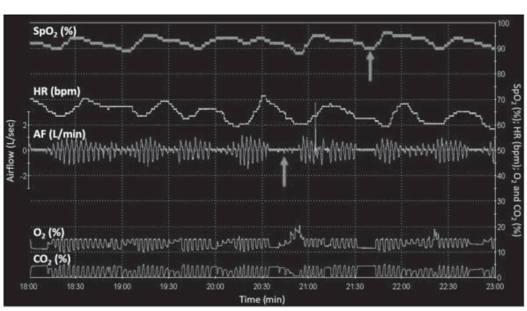

Figure 1 Respiratory variables recorded during hypoxia altitude simulation test showing periodic breathing in a patient with idiopathic pulmonary fibrosis. The picture shows a segment extracted from 18–23 min of the test record (13–18 min of the hypoxic period). Lag between ventilation and corresponding change in oximetry can be appreciated (red arrows). AF, airflow; HR, heart rate; CO_2, capnography; O_2, oxygen percentage; SpO_2, pulse oximetry.

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