Case Report

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Association between Covid-19 infection and platypnea–orthodeoxia syndrome

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Introduction and importance: Platypnea–orthodeoxia syndrome is defined as dyspnoea and deoxygenation when changing from a recumbent to an upright position. Post-Covid-19 sequelae can induce or exacerbate pulmonary hypertension and thereby render a previously mild and asymptomatic platypnea–orthodeoxia syndrome to manifest with new or worsening symptoms.

Case presentation: The authors present the case of an 80-year-old man who following an episode of moderate-severe Covid-19 infection developed type I respiratory failure that required hospital discharge with long-term oxygen therapy. He had a background history of postural paroxysmal hypoxaemia which had previously raised the suspicion of a right-to-left shunt through either a patent foramen ovale, atrial septal defect or an intrapulmonary arteriovenous malformation. However, given the low burden of symptoms this was not explored further. Following recovery from Covid-19 infection, the patient experienced marked dyspnoea and oxygen desaturation in an upright position that was relieved by a return to a supine position.

Discussion and conclusion: Persistent dyspnoea and hypoxia are common symptoms in patients who experience post-Covid-19 syndrome. However, when patients with prior moderate-to-severe Covid-19 illness present with new onset breathlessness and/or desaturation that is worsened in an upright position, platypnea–orthodeoxia syndrome should be considered.

Keywords: Covid-19 infection, dyspnoea, hypoxaemia, patent foramen ovale, platypnea–orthodeoxia syndrome

Introduction

Cardiovascular complications associated with SARS-CoV-2 infection are common and extend to involvement of both the right and left side of the heart[1]. In addition, hypoxaemia may occur secondary to lung injury or myocarditis that results in heart failure. Several reports have also suggested that both intrapulmonary shunting and/or acute right-to-left shunt through the interatrial septum induced by acute respiratory distress syndrome, may also contribute to hypoxia in Covid-19[2–4]. Furthermore, post-Covid-19 sequelae can induce or exacerbate pulmonary hypertension and thereby render a previously mild and asymptomatic platypnea–orthodeoxia syndrome (POS) to be more significant. POS is defined as dyspnoea and deoxygenation when changing from a recumbent to an upright position. Overall, there have been few original studies on POS in Covid-19 patients with most evidence arising from published case series and reports.

HIGHLIGHTS

- Platypnea–orthodeoxia syndrome (POS) is defined as dyspnoea and deoxygenation when changing from a recumbent to an upright position.
- Post-Covid-19 sequelae can induce or exacerbate pulmonary hypertension and thereby render a previously mild and asymptomatic POS to be more significant.
- When patients with prior moderate to severe Covid-19 illness present with new onset breathlessness and/or desaturation that is worsened in an upright position, POS should be considered in the differential diagnosis.

Case presentation

In the current report we describe the case of an 80-year-old man with a background history of hepatic steatosis, moderate bicuspid aortic valve stenosis (peak velocity 3.4 m/s) with an ascending aortic aneurysm and preserved left ventricular systolic function. The patient had not been vaccinated against Covid-19 and acquired Covid-19 infection with a moderate to severe illness that necessitated a relatively long hospital stay. During this, he developed type I respiratory failure that required discharge from hospital with long-term oxygen therapy. Noteworthy was that during a prior hospitalization 4 years earlier, a paroxysmal hypoxaemia associated with postural change had been documented. This had initially raised the suspicion of a right-to-left shunt through either a patent foramen ovale (PFO) or

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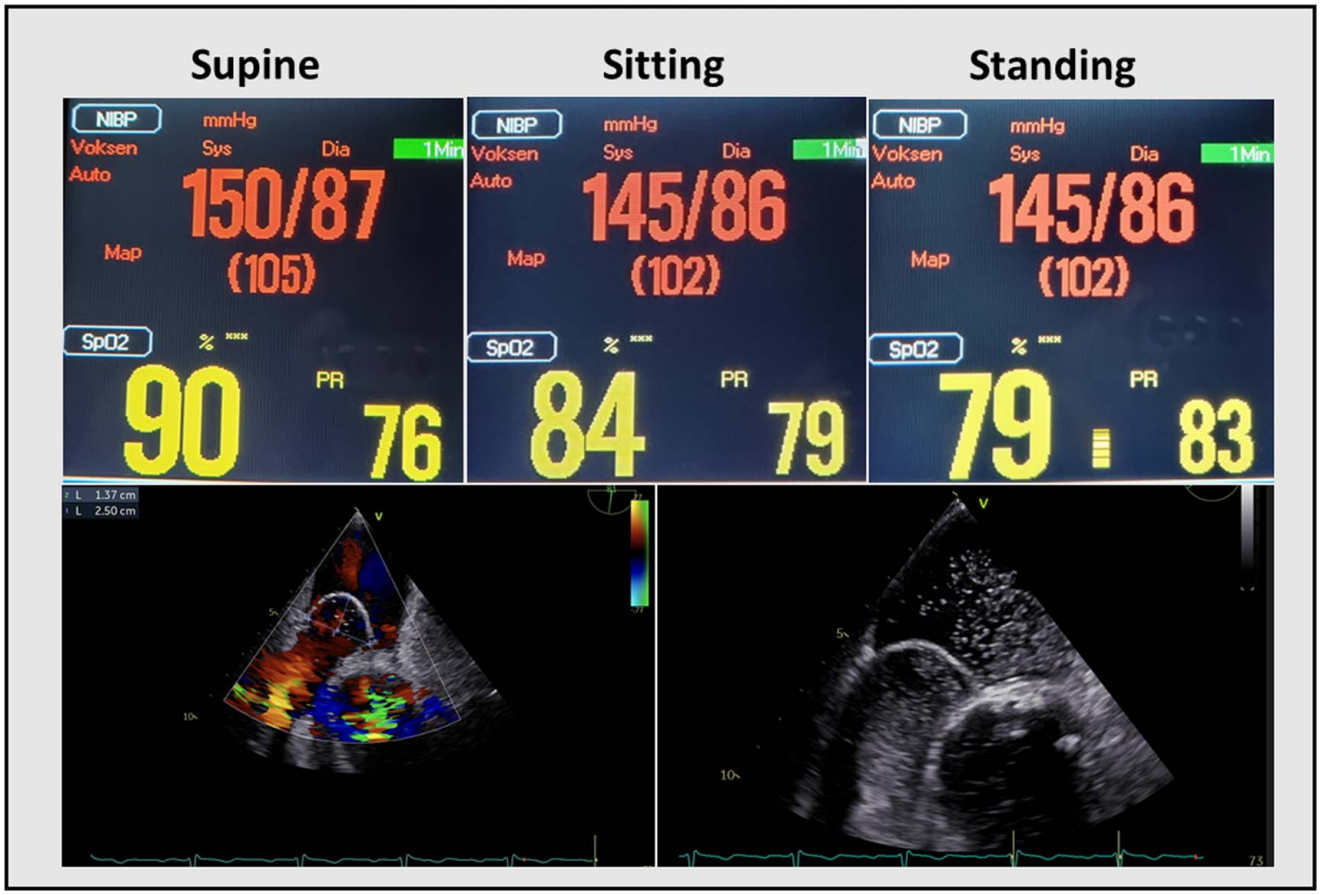

Figure 1. Changes in hemodynamic parameters from supine to sitting and standing positions (upper panel), and transoesophageal echocardiography images showing a significant patent foramen ovale and atrial septal aneurysm by the crossing a large volume bubbles into the left atrium (lower panel).

intrapulmonary arteriovenous malformation. A bubble study with agitated saline, however, had been inconclusive and given the low burden of symptoms this was not pursued further. Following the index Covid-19 infection, the patient however developed marked dyspnoea and oxygen desaturation in an upright position that was relieved by a return to a supine position (Fig. 1, upper panel). A suspected diagnosis POS was made, and a transoesophageal echocardiogram was performed with agitated blood saline. This confirmed a moderate to severe right-to-left shunt through a significant PFO by the crossing a large volume (>50) bubbles (agitated saline) into the left atrium (Fig. 1, lower panel). An atrial septal aneurysm with a bidirectional movement and bulging extent greater toward the left atrium and lesser toward the right atrium (type 4LR by Olivares classification)[5], was also detected. There was no measurable pressure gradient on the mild tricuspid regurgitant to assess pulmonary artery pressure. However, the right ventricle was slightly dilated with a preserved long-axis function (tricuspid annular plane systolic excursion 2 cm). Following a discussion with the patient he elected for a conservative management strategy owing to his age, comorbidities, and status as a Jehovah's Witness.

Discussion

POS is a rare clinical condition characterized by positional dyspnoea and arterial desaturation (drop in oxygen saturation by SaO2 greater than 5% from supine to an upright position). Agrawal *et al.*[6]. reviewed 150 articles of 239 POS cases with regard to aetiology and pathophysiology of POS and concluded that intracardiac shunt between the two atria was the most common cause of POS (87% patients). Treatment of POS due to an intracardiac shunt involves percutaneous or surgical closure of the PFO/atrial septal defect, and the decision to treat is commonly undertaken after a careful risk-benefit assessment of the patient. Symptom improvement with percutaneous closure is usually observed in vast majority of patients.

Persistent dyspnoea and hypoxia are not uncommon symptoms in patients who experience post-Covid-19 syndrome. Overall, there have been few original studies on POS in Covid-19 patients with most evidence arising from published case series and reports. Indeed, in a retrospective study from India, 15 of the 53 (28%) patients with moderate Covid-19 were diagnosed with POS[7], highlighting the fact that POS associated with Covid-19 is more common than initially suspected, especially during the initial stages of the pandemic. Furthermore, in a recent work by Tanimoto *et al.*[8], a total of 17 case reports including 23 patients with POS associated Covid-19 were reported. The time from Covid-19 onset or hospitalization to POS diagnosis was reported to range from 4 to 28 days. Many of these patients showed computed tomography findings of ground-glass opacification and consolidation predominantly in bilateral lower lobes and lung bases, leading to poor ventilation due to gravitational

shunting of blood, and required respiratory support with oxygen supplementation and invasive and non-invasive mechanical ventilation. An intracardiac shunt (PFO) was found in three cases and pulmonary embolism in other three cases, although the authors acknowledged that pulmonary micro-thrombosis and vasculopathy which were not detectable by computed tomography might also have contributed to POS. Of note, most patients recovered within 4 days to ~2 months, showing a relatively good prognosis for Covid-19-associated POS, while three patients required long-term oxygen therapy after discharge, as was the case in our patient.

When patients with prior moderate to severe Covid-19 illness are admitted with new onset breathlessness and desaturation that is worsened in an upright position, POS should be suspected. Although the precise mechanism of positional dyspnoea and hypoxaemia in POS is unclear, it is hypothesized that positional alterations in atrial septal geometry and associated blood flow patterns may cause a dynamic right-to-left shunting through a PFO or atrial septal defect. However, POS may also be caused by extracardiac shunts in the context of Covid-19 pneumonia, interstitial lung disease and hepatopulmonary syndrome with dilatation of pulmonary capillaries, leading to ventilation-perfusion mismatch and reduced alveolar-arterial oxygen diffusion. Post-Covid-19 sequelae can induce or exacerbate pulmonary hypertension, and thereby render a previously mild and asymptomatic POS to be more significant that needs consideration of treatment as presented in the current case.

Ethical approval

This clinical case report was not applicable for ethical approval.

Consent

Consent was obtained from the patient for reporting this case study and the accompanying image.

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This case study was not funded.

Author contribution

Completed during online submission.

Conflicts of interest disclosure

The authors declare that they have no financial conflict of interest with regard to the content of this report.

Guarantor

Sahrai Saeed.

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