Platypnoea–orthodeoxia syndrome: beware of investigations undertaken supine

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ABSTRACT
Platypnoea–orthodeoxia syndrome (POS) is a rare disorder, manifesting as deoxygenation occurring when the patient is in the upright position. Four broad mechanisms for the condition have been described: intracardiac shunts, intrapulmonary shunts, hepatopulmonary syndrome and pulmonary ventilation–perfusion mismatch. Here, we present the first case of POS in a patient with a proven right to left intracardiac shunt occurring in the context of postural hypotension and normal right heart pressures. We highlight the need to carry out investigations in the upright position before discounting intracardiac shunting as a cause for the syndrome. Short-term improvement of the syndrome was obtained with medical management of the patient’s orthostatic hypotension and as such suggests a conservative management strategy for similar patients, which may delay the need for invasive procedures to close the anatomical defect.

RP (Senior House officer): An 85-year-old man presented with 2 weeks of intermittent shortness of breath. His medical history included bilateral pulmonary emboli, for which he was taking apixaban 5 mg twice daily, Parkinson’s disease, benign prostatic hypertrophy and overactive bladder. He had never smoked.

On examination, his chest was clear, heart sounds were normal and he was clinically euvoeulaic. Fingertip oxygen saturation (SpO2) was 75% seated and he had type 1 respiratory failure with a PaO2 of 6.7 kPa and PaCO2 of 4.3 kPa breathing room air. D-dimer was raised at 1111 ng/mL and he underwent CT pulmonary angiography which excluded pulmonary emboli, for which he was taking apixaban and this was particularly true of the cardiac MRI imaging failed to disclose evidence of pulmonary veno-occlusive disease. However, in order to locate the anatomical position of the shunt he underwent contrast-enhanced echocardiography revealing a significant left to right shunt at the atrial level. Cardiac MRI confirmed the presence of a patent foramen ovale (PFO) but again did not demonstrate a significant shunt. Left and right heart catheterisation showed unobstructed coronaries and normal pulmonary pressures, respectively. The calculated pulmonary to systemic blood flow ratio was within the normal range for the methodology used (0.9).

Our investigations failed to demonstrate a cause for respiratory failure and as intracardiac shunting seemed unlikely, we considered the possibility of an intrapulmonary shunt. The patient was transferred to the regional respiratory centre.
The patient underwent percutaneous closure of his PFO, with status. However, the improvement proved unsustained and he commenced treatment with fludrocortisone was increased to 400 µg. To further support his blood pressure, fludrocortisone was increased to 400 µg. Medications, we initiated treatment with fludrocortisone 200 µg. Following 1 week of fludrocortisone treatment, the patient no longer reported positional dyspnoea. His upright SpO₂ was 88% and blood pressure was 101/66 mm Hg. He returned to the referring hospital. To further support his blood pressure, fludrocortisone was increased to 400 µg and he commenced treatment with midodrine. These medications were tolerated well and attenuated the severity of his POS for 3 months, allowing the patient to receive physiotherapy and restore his functional status. However, the improvement proved unsustained and the patient underwent percutaneous closure of his PFO, with complete resolution of his syndrome.

DISCUSSION

Fl, FG, MIP: POS is a rare clinical syndrome which describes deoxygenation and dyspnoea when the patient is in the upright position. To date, less than 200 cases have been described in the literature. Four broad mechanisms for this syndrome have been described: intracardiac shunts, intrapulmonary shunts, hepatopulmonary syndrome and pulmonary ventilation–perfusion (VQ) mismatch. The pathophysiology of the latter three is straightforward. The majority of AVMs occur in the lung bases. In an upright position, more blood is diverted to the base of the lung thereby increasing movement of deoxygenated blood into the systemic circulation. The same gravitational mechanisms could explain increased blood flow through hepatic collaterals in the case of hepatopulmonary syndrome, or pulmonary anastomoses which are also a feature of that condition. Similarly, in cases of VQ mismatch, the upright position augments the physiological deadspace in the upper zones of the lungs, which may be sufficient to cause deoxygenation in cases of severe lung parenchymal or thromboembolic disease.

Although the most commonly described, POS in the context of an intracardiac shunt is more challenging to explain. The right to left shunt occurs despite normal right heart pressures, as seen in the present case. Some authors have proposed that the upright position results in a transient rise in right atrial pressure when the patient has a less compliant right atricle (RV). RV filling pressures reduce on standing but flow through the left ventricle increases causing it to become more compliant relative to the stiff RV, which resists filling from the right atrium. Thus, blood flows preferentially via the septal defect into the more compliant left side of the heart. Consistent with this theory, POS caused by intracardiac shunts has mostly been reported in the elderly population, and compliance of the RV is known to reduce with age. Cases have also been reported in patients with RV infarcts, eosinophilic endomyocardial disease and constrictive pericarditis, all of which could preferentially reduce RV compliance.

We describe the first case of POS in a patient with a proven right to left intracardiac shunt occurring in the context of postural hypotension. Although not a well-recognised association, three cases of POS in the context of orthostatic hypotension secondary to autonomic failure, diabetes and Parkinson’s disease have been described. Interestingly, none of these patients had evidence of an intracardiac shunt, although this was not sought directly by Fox and colleagues. These authors did, however, use transient fluid loading to confirm that the shunting could be corrected by resolving hypotension, although we did not feel ethically able to attempt this in our patient.

Furthermore, we have demonstrated that shunting only occurred when upright and that its severity could be attenuated by manipulating medications to raise his blood pressure. We hypothesise that as a result of orthostatic hypotension, his systemic vascular resistance failed to rise sufficiently on standing to maintain his mean arterial pressure (MAP). When combined with age-related stiffness of his RV, this fall in MAP could cause a transient rise in right atrial pressure relative to the left atrium, resulting in a significant shunt. The improvement of his POS on treatment of his orthostatic hypotension supports this.

In summary, POS is a rare clinical syndrome which can be challenging to recognise. Although most cases are associated with a PFO, this is the first to suggest postural hypotension as a key driving factor for right to left shunting of blood. Furthermore, this is the first case to show improvement, although temporary, with conservative strategies, delaying the need for invasive interventions to close the defect. Importantly, intracardiac shunts should not be discounted as a cause for POS unless the investigations which do so are undertaken in the appropriate body position.

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