

Case Report

A case of unexplained cyanosis

PRASHILLA SOMA, SHIRAZ ELLEMDIN

Abstract

It is now clear that hepatopulmonary syndrome (HPS) may occur and contribute significantly to gas exchange abnormalities in the setting of other cardiopulmonary abnormalities. Since there is no gold-standard diagnostic test for HPS, diagnosis rests on documenting arterial oxygenation abnormalities resulting from intrapulmonary vasodilatation in the setting of liver disease. Retrospective studies suggest that many patients with HPS develop progressive intrapulmonary vasodilatation over time and that mortality is significant. This case highlights the clinical value in investigating for HPS and right-to-left shunts when confronted with a patient presenting with unexplained hypoxia in combination with platypnoea and/or orthodeoxia.

Keywords: cyanosis, hepatopulmonary syndrome, hypoxaemia

Submitted 22/8/11, accepted 11/4/12

Cardiovasc J Afr 2012; 23: e11–e12

www.cvja.co.za

DOI: 10.5830/CVJA-2012-033

Case report

A 26-year-old female presented to our casualty department in March 2004 with the main symptom of progressive dyspnoea in the absence of orthopnoea or paroxysmal nocturnal dyspnoea, with associated marked impaired effort tolerance and generalised weakness. The onset of symptoms coincided with a vague episode of blunt chest trauma. There was no chest pain or palpitations. She further reported being blind in the right eye. Her past medical history included surgical removal of a non-functional pituitary macro-adenoma eight years previously, with insertion of a ventriculo-peritoneal (V-P) shunt and post-surgical radiotherapy.

On general examination, her height was 146 cm with minimal secondary sexual characteristics. Her vitals included a temperature of 37°C, blood pressure of 93/62 mmHg, pulse of 80 beats/minute, respiratory rate of 18 breaths/minute, with central and peripheral cyanosis. It was also noted that she was less dyspnoeic and cyanotic in the supine position. Auscultation of the chest revealed normal breath sounds with a physiologically

split second heart sound. She was blind in the right eye with a pale optic disc and visual field defects in the left eye.

Investigations for the cyanosis included a blood gas, the results of which are shown in Table 1, a ventilation perfusion scan, chest radiograph, high-resolution CT chest and pulmonary arteriogram, all of which were normal. The echocardiogram showed normal cardiac function with normal chamber sizes and no shunts. The polysomnogram performed revealed no abnormalities. In addition, a 100% oxygen shunt study was done, which suggested a 15.4% shunt, the details of which are illustrated in Table 2. Lung functions could not be done due to poor co-operation from the patient.

In view of the platypnoea and orthodeoxia, transthoracic and transoesophageal echocardiograms were performed. Both revealed an interatrial shunt in the supine position within three cardiac cycles of injecting. The transthoracic echocardiogram was diagnostic for the sitting position as well. A final diagnosis of patent foramen ovale with right-to-left shunting was established despite normal intracardiac pressures.

The patient underwent open-heart surgery on 22 April 2004 for the closure of an alleged patent foramen ovale. However, no intracardiac shunt or anomalous drainage could be defined at cardiac surgery. She died at home on 8 May 2004 while recovering from surgery.

A post mortem was performed on 11 May 2004. The major finding consisted of a thrombo-embolus lodged deep within the right pulmonary artery. In addition, multiple small thrombi were noted adhered to the right atrial wall. The thrombus had developed in the area of the previous surgery, from where it gave origin to the thrombo-embolism that had caused the patient's sudden death.

A further finding was a massive right-sided pleural effusion

TABLE 1. RESULTS OF THE ARTERIAL BLOOD GAS IN DIFFERENT POSITIONS

Room air	Sitting	45 degrees	Supine
Oxygen saturation (%)	69	81	83
Partial pressure oxygen (mmHg)	26	31	35
Partial pressure carbon dioxide (mmHg)	17	19	20

TABLE 2. RESULTS OF 100% OXYGEN SHUNT STUDY

Arterial blood gas	Oxygen saturation (%)	Partial pressure oxygen (mmHg)	Partial pressure carbon dioxide (mmHg)	Bicarbonate (mmol/l)
Room air	56	33	23	13
40% oxygen	78	47	24	13
100% oxygen	99	379	22	13

Department of Physiology, University of Pretoria, Pretoria, South Africa

PRASHILLA SOMA, MB ChB, MSc (Clin Epi), prashilla.soma@up.ac.za

Department of Internal Medicine, University of Pretoria, Pretoria, South Africa

SHIRAZ ELLEMDIN MB ChB, MMed (Int Med)

(1 000 ml). Effusions were also noted within the left thoracic cavity (200 ml), pericardium (350 ml) and peritoneum (500 ml).

The other major finding at post mortem was the presence of a small fatty liver. Histology revealed the presence of cirrhosis, with prominent fibrotic bands. After extensive special stains, the diagnosis was cryptogenic cirrhosis.

The lungs appeared to be within normal limits at post mortem, but histology revealed prominent dilatation of the vasculature of both lungs, consistent with the hepatopulmonary syndrome. Examination of the brain and endocrine systems confirmed the clinical findings.

Discussion

Platypnoea (dyspnoea induced by the upright position and relieved by recumbency) and orthodeoxia (arterial deoxygenation accentuated by the upright position and improved during recumbency) is a rare and poorly understood syndrome of orthostatic accentuation of a right-to-left shunt, usually across a patent foramen ovale.¹ Another unusual condition involving right-to-left shunting, while usually chronic, can present in a very similar fashion to right-to-left interatrial shunt, i.e. with hypoxaemia, platypnoea, orthodeoxia and a positive bubble contrast echocardiograph; hepatopulmonary syndrome (HPS).²

HPS is defined as the triad of liver disease, pulmonary gas exchange abnormalities leading to arterial deoxygenation, and widespread pulmonary vascular dilatation.³ The hallmark of pulmonary vascular changes in HPS are dilated vessels at the pre-capillary and direct arterio-venous communications.³ This causes right-to-left shunting of blood flow, mismatch between ventilation and perfusion, and diffusion limitations. Pulmonary features include digital clubbing, cyanosis, dyspnoea, platypnoea and orthodeoxia.³

Impaired arterial oxygenation is a hallmark of HPS. Mild hypoxaemia is a frequent feature of chronic liver disease; it occurs in approximately one-third of all patients. By contrast, severe hypoxaemia ($\text{PaO}_2 < 60$ mmHg) is less common with cirrhosis alone and is usually without associated cardiopulmonary disease. In the absence of independent lung disease, severe hypoxaemia in the setting of liver disease suggests the possibility of HPS.⁴

From a physiological viewpoint, HPS provides an excellent

model for clinical research in the pathophysiology of pulmonary gas exchange. So far it has been possible to show that arterial hypoxaemia in this condition is (1) partitioned into components resulting from ventilation-perfusion (VA/Q) mismatching, intrapulmonary shunt and limitations of oxygen diffusion; (2) modulated by the interplay between the intrapulmonary and the extrapulmonary determinants of PaO_2 , such as cardiac output and minute ventilation; (3) vulnerable to the influence of inadequate pulmonary vascular tone, and (4) resolved when the injured liver is replaced and hepatic function is restored to within normal limits.⁴

Contrast-enhanced echocardiography is considered to be standard in the diagnosis of HPS. In subjects with normal pulmonary vasculature, microtubules become lodged in the pulmonary circulation and are absorbed. The appearance of microtubules in the left side of the heart indicates right-left shunts, while bubbles that appear in the left heart immediately after they have appeared in the right atrium are suggestive of an intracardiac shunt.^{5,6}

Conclusion

A high clinical suspicion of right-to-left interatrial shunts and HPS should be considered in the setting of unexplained hypoxia, especially with associated platypnoea and or orthodeoxia.

References

1. Seward JB, Hayes DL, Smith HC, *et al.* Platypnea-orthodeoxia: clinical profile, diagnostic workup, management and report of seven cases. *Mayo Clin Proc* 1984; **59**: 221-231.
2. Isaac J. Hypoxemia, platypnoea, orthodeoxia and right to left shunt. *Br J Anaesth* 2001; **86**(4): 594-602.
3. Yilmaz S, Dursum M, Canoruc F, *et al.* A severe (type II) hepatopulmonary syndrome in a patient with idiopathic portal hypertension and treatment with paroxetine. *J Med* 2005; **63**(11): 448-452.
4. Mohammed Alizadeh AH, Fatemi SR, Mirzaee V, *et al.* Clinical features of HPS in cirrhotic patients. *Wld J Gastroenterol* 2006; **12**(12): 1954-1956.
5. Leung AN. Case 63: Hepatopulmonary syndrome. *Radiology* 2003; **229**(1): 64-67.
6. Krowka MJ, Wiseman GA, Burnett OL, *et al.* Hepatopulmonary syndrome. *Chest* 2000; **118**: 615-624.