

Discussion

Our study in a group of Chinese nonagenarians in Singapore who already has “success” in longevity allowed important insights into factors that promote aging successfully. Using the Katz approach of viewing successful aging from the perspective of multidimensional measurements, our study affirmed the utility of a multidimensional approach beyond the biomedical model.³ Of note, the most striking difference between successful agers and nonagenarians with disability was in terms of psychological factors such as optimism, resilience, conscientiousness, low neuroticism, and fewer depressive symptoms; lifestyle factors such as low nutritional risk and engagement in activity; and social factors such as a good marital relationship. With the exception of stroke, disease factors appeared to be less salient in this long-lived group. Ironically, in our study, SA nonagenarians had a higher prevalence of hypertension, hyperlipidemia, and diabetes mellitus. Our results are consistent with the recommendations of the World Health and Aging Report of the World Health Organization, which emphasizes that “healthy aging is more than just the absence of disease” and highlights the importance of raising the intrinsic capacity throughout the life course.¹⁰ Taken together, this highlights the importance of using age-sensitive multidimensional definitions of successful aging in the oldest-old that encompass psychosocial domains.³ Our findings also suggest the potential of a life-course approach of culturally appropriate and evidence-based interventions that target lifestyle, environmental, and psychosocial dimensions to promote aging successfully that will support aging-in-place.¹¹ This is supported by recent work published showing interactions between familial longevity and environmental factors that affect health in old age in China.¹²

In summary, using an enriched sample of successfully aged versus disabled nonagenarians, we demonstrated the salience of psychological, lifestyle, and social dimensions above and beyond the biomedical model. Because of the cross-sectional design, we cannot exclude reverse causality and, hence, the reported associations should preferably be replicated in longitudinal studies. To complement our findings that examines successful aging using the Rowe and Kahn paradigm, we also propose studies that examine successful aging using the complementary Havighurst approach of understanding successful aging from the perspectives of older persons themselves.³

References

1. Rowe JW, Kahn RL. Human aging: Usual and successful. *Science* 1987;237:143–149.
2. Nosratty L, Sarkeala T, Hervonen A, Jylhä M. Is there successful aging for nonagenarians? The vitality 90+ study. *J Aging Res* 2012;2012:9.
3. Michel JP, Sadana R. “Healthy aging” concepts and measures. *J Am Med Dir Assoc* 2017;18:460–464.
4. Young Y, Frick KD, Phelan EA. Can successful aging and chronic illness coexist in the same individual? A multidimensional concept of successful aging. *J Am Med Dir Assoc* 2009;10:87–92.
5. Sahadevan S, Lim PP, Tan NJ, Chan SP. Diagnostic performance of two mental status tests in the older Chinese: Influence of education and age on cut-off values. *Int J Geriatr Psychiatry* 2000;15:234–241.
6. Neelakantan N, Whitton C, Seah S, et al. Development of a semi-quantitative food frequency questionnaire to assess the dietary intake of a multi-ethnic urban Asian population. *Nutrients* 2016;8:528.
7. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A re-evaluation of the Life Orientation Test. *J Pers Soc Psychol* 1994;67:1063–1078.
8. Connor KM, Davidson JR. Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depress Anxiety* 2003;18:76–82.
9. Friedman HS, Martin LR. *The Longevity Project: Surprising Discoveries for Health and Long Life From the Landmark Eight-Decade Study*. New York: Hudson Street Press; 2011.

10. Beard JR, Officer A, de Carvalho IA, et al. The World Report on ageing and health: A policy framework for healthy ageing. *Lancet* 2016;387:2145–2154.
11. Morley JE. Aging successfully: The key to aging in place. *J Am Med Dir Assoc* 2015;16:1005–1007.
12. Shi WH, Zhang HY, Zhang J, et al. The status and associated factors of successful aging among older adults residing in longevity areas in China. *Biomed Environ Sci* 2016;29:347–355.

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Platypnea-Orthodeoxia Syndrome Masked by Delirium in an 85-Year-Old Woman



To the Editor:

On February 3, 2016, an 85-year-old woman was brought to the emergency department (ED) because of mental confusion and intolerance of the sitting position, which had begun suddenly 2 days before. She had been wheelchair-bound for the past 9 years after a stroke that had left her with mild left-sided hemiparesis but

without cognitive impairment. According to her medical records at the ED, she was initially found hypoxemic ($SO_2 = 75\%$ in room air) and disoriented. She was diagnosed with pneumonia, and because there was major improvement regarding her oxygenation after hydration ($SO_2 = 94\%$ in room air), she was discharged home with a prescription of oral amoxicillin-clavulanate. Six weeks later, during an ambulatory consultation her family reported that she had remained confused and agitated especially during the night and that the patient became distressed every time they attempted to sit her up. They had to offer her food while she was lying down on her bed because she would not tolerate the upright position at all. During consultation, she had an oxygen saturation of 86% in room air while recumbent and was referred for hospital admission on the same day for the assessment of her hypoxemia and other possible organic causes of her mental status change. Platypnea-orthodeoxia syndrome (POS) was determined the cause of her orthostatic intolerance as even on oxygen therapy her oxygen saturation fell from 95% to 84% when changing from decubitus to the upright position.

Transcranial Doppler scan with microbubbles contrast showed microbubbles within the middle cerebral artery 5 cardiac cycles after infusion, which is characteristic of extracardiac right-to-left shunt.¹ Transesophageal echocardiography with microbubbles contrast ruled out the presence of any interatrial communication and disclosed severe pulmonary hypertension (systolic pulmonary arterial pressure of 81mmHg). Chest angiotomography revealed lingular pulmonary infarction and multiple foci of chronic pulmonary embolism involving the medium lobe, the right superior lobe, and subsegmental branches of the lower left lobe. Laboratory tests did not disclose hepatic dysfunction.

The patient was anticoagulated and discharged home on oxygen therapy after 3 weeks of hospitalization. Her cognitive status improved; she experienced only mild improvement regarding her orthostatic intolerance.

POS is a rare syndrome represented by dyspnea and hypoxia induced by orthostasis and relieved by decubitus. The proposed pathophysiology of POS involves 3 mechanisms: intracardiac shunt, ventilation/perfusion mismatch, and pulmonary arteriovenous shunt.²

Intracardiac right-to-left shunts represent the most common causes of POS and are usually associated with patent foramen ovale or interatrial septal defects in the presence of other anatomic or functional disorders.¹ The requirement for another functional or anatomic disorder in the presence of interatrial malformations is the reason why POS occurs most frequently in older adults. It is believed that anatomic alterations such as kyphosis and aortic dilation lead to changes in the shape of the right atrium, which would align the inferior vena cava outflow with a patent foramen ovale or interatrial defect, hence, leading to the passage of deoxygenated blood from the right atrium directly to the left atrium.² Pulmonary hypertension represents the most common functional disorder associated with POS in the presence of interatrial septum malformations. It is assumed that interatrial communications become stretched when patients are upright, therefore, increasing the magnitude of right-to-left shunt in that position.

Hepatopulmonary syndrome and vascular malformations are examples of arteriovenous shunts. In hepatopulmonary syndrome, the endogenous production of nitric oxide is increased, leading to precapillary and capillary vasodilation predominantly in the basal lung segments.¹ During orthostasis, when blood flow to the basal

segments is increased, such capillary dilation would allow the direct passage of deoxygenated blood into the pulmonary veins. The same mechanism would occur in arteriovenous malformations or fistulae of basal location.

Ventilation/perfusion mismatch represents the least reported cause of POS. Recently, a case of POS was reported in a patient with bilateral basal pulmonary fibrosis.³ In that case, the authors argued that the upright position caused relative hypoperfusion of healthy pulmonary apex regions and greater perfusion of the diseased basal segments, hence, maximizing the existing ventilation/perfusion mismatch.

We hypothesize that our patient's platypnea resulted from a combination of ventilation/perfusion mismatch and pulmonary arteriovenous shunt. We believe she suffered an acute pulmonary embolism, which was initially misdiagnosed as community-acquired pneumonia and evolved into chronic pulmonary embolism with severe pulmonary hypertension. The presence of pulmonary emboli affecting the lower lobes could have caused the ventilation-perfusion mismatch that worsened oxygenation in the upright position. Extracardiac right-to-left shunt, demonstrated by the transcranial Doppler scan with microbubbles contrast, could have resulted from the opening or recruitment of intrapulmonary arteriovenous anastomoses because of increased pulmonary microvasculature pressure and chronic hypoxemia.^{4,5} Because of delirium, she was unable to report breathlessness while upright and her recorded SO_2 improvement at the ED could have resulted from measurement in decubitus and/or from increased perfusion of upper lung regions because of improved preload after hydration. It is possible that other cases of POS in older patients with cognitive impairment and chronic oxygen dependence also go undiagnosed because POS is rarely suspected. POS should be entertained as a diagnostic possibility in cases of agitation triggered by the upright position in older adults with delirium or dementia.

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References

1. De Vecchis R, Baldi C, Ariano C. Platypnea-orthodeoxia syndrome: Multiple pathophysiological interpretations of a clinical picture primarily consisting of orthostatic dyspnea. *J Clin Med* 2016;5:E85.
2. Rodrigues P, Palma P, Sousa-Pereira L. Platypnea-orthodeoxia syndrome in review: Defining a new disease? *Cardiology* 2012;123:15–23.
3. Takhar R, Biswas R, Arora A, Jain V. Platypnoea-orthodeoxia syndrome: novel cause for a known condition. *BMJ Case Rep* 2014;2014:bcr2013201284. <http://dx.doi.org/10.1136/bcr-2013-201284>.
4. Lovering AT, Goodman RD. Detection of Intracardiac and Intrapulmonary Shunts at Rest and During Exercise Using Saline Contrast Echocardiography. In: Ainslie P, editor. *Applied Aspects of Ultrasonography in Humans*. Rijeka: InTech; 2012. p. 159–174.
5. Vodoz JF, Cottin V, Glerant JC, et al. Right-to-left shunt with hypoxemia in pulmonary hypertension. *BMC Cardiovasc Disord* 2009;9:15.

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