

# Wandering fourth heart sound

Takahiro Kunigita, Kensuke Matsumoto \*, Satoru Kawasaki, and Hogara Nishisaki

Department of Internal Medicine, Hyogo Prefectural Tamba Medical Center, 2002-7, Hikami-cho Iso, Tamba, Hyogo 669-3495, Japan

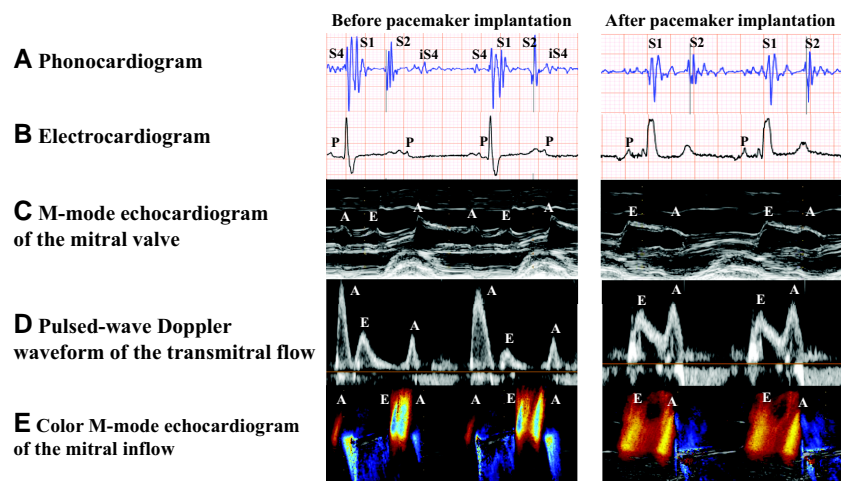
Received 7 March 2022; first decision 14 June 2022; accepted 4 August 2022; online publish-ahead-of-print 6 August 2022

## Case description

An 86-year-old woman with uncontrolled hypertension was referred to our institution owing to significant bradycardia caused by complete atrioventricular block. Chest radiography revealed bilateral pulmonary congestion concomitant with significant cardiomegaly, and brain natriuretic peptide level was elevated at 430 pg/mL, indicating acute decompensated heart failure. Cardiac auscultation revealed grade 2/6 systolic ejection murmur along with intermittent augmentation of the first heart sound (i.e. 'Cannon sound'). Unexpectedly, a low-pitched strange heart sound was intermittently auscultated at the apex. Of note, this peculiar heart sound was completely coincided with prominent *a* wave in the jugular venous pulsation, which suggested that this excessive heart sound was generated by atrial contraction. Phonocardiogram revealed the strange heart sound to be an isolated fourth heart sound (iS4), corresponding to non-

conducted P wave on electrocardiogram, resulting in strange heart rhythm accompanied by 'wandering iS4' (Figure 1A and B). Transthoracic echocardiography clearly confirmed the iS4 was generated by atrial kick independent of ventricular contraction (Figure 1C–E). After dual chamber pacemaker implantation (active mode: atrial sensing and ventricular pacing mode), signs and symptoms of heart failure were significantly alleviated with the complete disappearance of the 'wandering iS4.'

S4 is generated by a compensatory increase in the atrial booster pump function against an increased ventricular end-diastolic pressure and a non-compliant ventricle.<sup>1</sup> In the present case, 'wandering iS4' was clearly auscultated presumably due to incidental combination of significant bradycardia resulting from complete atrioventricular block, non-compliant ventricle caused by uncontrolled hypertension, presence of the ventricular apex with sufficient vibration capability, and integrity of compensatory augmentation of the atrial booster pump function.



**Figure 1** Before pacemaker implantation (left panel), phonocardiogram (A) clearly showed an isolated fourth heart sound, corresponding to non-conducted P wave on electrocardiogram (B). M-mode echocardiogram (C), Pulsed-wave echocardiogram (D), and colour M-mode echocardiogram (E) confirmed the isolated fourth heart sound was generated by atrial kick independent of ventricular contraction. After dual chamber pacemaker implantation, the 'wandering isolated fourth heart sound' was completely disappeared (right panel).

\* Corresponding author. Tel: +81 795 88 5200 Fax: +81 795 88 5210, Email: [kenmatsu@med.kobe-u.ac.jp](mailto:kenmatsu@med.kobe-u.ac.jp)

Handling Editor: Costantino Mancusi

Peer-reviewers: Giulia Elena Mandoli

© The Author(s) 2022. Published by Oxford University Press on behalf of the European Society of Cardiology.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (<https://creativecommons.org/licenses/by-nc/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact [journals.permissions@oup.com](mailto:journals.permissions@oup.com)

## Acknowledgements

The authors would like to thank Arisa Senda, Ryu Sugimoto, Yuto Shinkura, and Masahiko Hoshijima for their assistance.

**Consent:** The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

**Conflict of interest:** None declared.

**Funding:** None declared.

## Reference

1. Gupta S, Michaels AD. Relationship between accurate auscultation of the fourth heart sound and the level of physician experience. *Clin Cardiol* 2009;**32**:69–75.