

Case Report

To Take One's Breath Away: Echocardiography-Guided Aspiration of an Air Embolism During a MitraClip Procedure

Sandra Hadjadj, MSc, David del Val, MD, Rosalie Robert, MSc, Jonathan Beaudoin, MD, Josep Rodés-Cabau, MD, and Jean-Michel Paradis, MD

Quebec Heart & Lung Institute, Laval University, Québec City, Québec, Canada

ABSTRACT

An air embolism (AE) is a rare but dreaded complication during endovascular procedures. Current guidance recommends hyperbaric oxygen therapy and aspiration for the management of a venous AE. However, the management of an arterial AE is much less described. We report a case of a 79-year-old man with symptomatic mitral regurgitation who underwent a MitraClip procedure. During the intervention, a massive AE was detected in the ascending aorta on transesophageal echocardiography. The AE was successfully aspirated while the patient remained hemodynamically stable. This report demonstrates the efficacy of an arterial AE's aspiration with a real-time echocardiography recording of the technique.



RÉSUMÉ

Une embolie gazeuse (EG) est une complication rare mais redoutée lors des interventions endovasculaires. Les directives actuelles recommandent l'oxygénothérapie hyperbare et l'aspiration pour la prise en charge d'une EG veineuse. Cependant, la prise en charge d'une EG artérielle est beaucoup moins bien décrite. Nous rapportons le cas d'un homme de 79 ans présentant une insuffisance mitrale symptomatique et ayant subi une procédure MitraClip. Au cours de l'intervention, une EG massive a été détectée dans l'aorte ascendante à l'échocardiographie transoesophagienne. L'EG a été aspirée avec succès alors que le patient est resté stable sur le plan hémodynamique. Ce rapport démontre l'efficacité de l'aspiration d'une EG artérielle avec un enregistrement en temps réel de la technique par échocardiographie.

Case Report

A 79-year-old man with chronic kidney disease, secondary hypertension, and atrial fibrillation was referred to our clinic for paroxysmal nocturnal dyspnea, dyspnea on exertion, and peripheral edema. Transthoracic echocardiography showed a normal left ventricular ejection fraction (53%) with a right ventricular systolic pressure of 70 mm Hg. Transesophageal echocardiography (TEE) revealed a severe myxomatous mitral regurgitation. Considering his frailty status and the severe chronic kidney disease (creatinine: 212 $\mu\text{mol/L}$, estimated glomerular filtration rate: 25 mL/min/1.73 m^2), the heart team elected for a MitraClip procedure.

Under general anaesthesia and TEE guidance, after an easy transseptal puncture, the first MitraClip was implanted in the region of the A3-P3 scallops. After removal of the clip delivery

system (CDS) with continuous aspiration with a 60 cc syringe, a massive air embolism (AE) was seen in the ascending aorta (AA) on TEE (Fig. 1A; Video 1 , view video online). The patient was hemodynamically very stable; no ST elevation was seen on the electrocardiogram, but broad QRS complexes were present even before the apparition of the AE. At that time, the priority was to avoid further AE. The fraction of inspired oxygen (FiO_2) was increased to 100%. The flush of normal saline was immediately stopped, and the portion of the steerable guide catheter (SGC) located outside the body was positioned vertically, which allowed potential residual air bubbles to rise. Continuous aspiration of the SGC was also performed. In extremis, a left femoral arterial access was obtained, and under fluoroscopy and TEE guidance, a 6 Fr Judkins right guiding catheter was brought close to the AE in the AA. Thanks to the shape of the Judkins right catheter, aggressive but very precise suction was performed to successfully aspirate the AE (Fig. 1; Video 2 , view video online). The aspirate was not frothy and looked like regular blood. As the patient remained hemodynamically stable, a second clip was implanted centrally (A2-P2 scallops). On TEE, there was mild-to-moderate residual mitral regurgitation and a mean mitral valve gradient of 2 mm Hg. Despite having aspirated a significant visible AE, we cannot guaranty that some air might have gone to other parts of the circulation. Nevertheless, the

Received for publication July 25, 2020. Accepted August 30, 2020.

Ethics Statement: The present research has adhered to the relevant ethical guidelines.

Corresponding author: Dr Jean-Michel Paradis, Quebec Heart & Lung Institute, 2725 Chemin Sainte-Foy, Québec City, Québec G1V 4G5, Canada. Tel.: +1-418-656-8711; fax: +1-418-656-4581.

E-mail: jean-michel.paradis@criucpq.ulaval.ca

See page 117 for disclosure information.

Novel Teaching Points

- Although AE is a rare complication, the complexity of the MitraClip procedure implies that physicians have to be ready to promptly detect and manage AE.
- A particular care should be taken during the removal of the CDS to avoid AE.
- Haemodynamic instability is not always present with AE, which highlights the importance of regular TEE checking.
- The aspiration of an arterial AE using a coronary catheter could be considered as a “lifesaving” therapeutic option.

patient was discharged home the next day without any new neurologic deficits or signs of myocardial infarction at 24-hour and 1-month follow-up.

Discussion

AE is a rare but dreaded complication during any structural heart or coronary intervention. Although the incidence of AE is not well known because of the nonspecific clinical signs and the difficulty in documenting this diagnosis; it is clearly established that an iatrogenic AE may result in severe morbidity and mortality.¹ In this case, we hypothesize that the AE would be created by the

complete apposition of the distal extremity of the SGC against the left atrial wall during removal of the CDS. This resulted in suction of air that embolized in the AA when the tip of the SGC was repositioned. This case emphasizes that a minor breakdown in the recommended technique can lead to a major complication, highlighting the necessity for the physician to take appropriate precautions while performing each step of the procedure. Interestingly, the AE was detected very early before any adverse events could be identified. This also demonstrates the importance of an adequate use of TEE when available, not only for guidance but also to reveal any complication related to those complex procedures.

Conclusion

To our knowledge, this is the first structural or interventional cardiology case report with a real-time recording of an arterial AE aspiration. Although this technique has been mostly described for a venous AE, this case further emphasizes the feasibility and the efficacy of aspiration when an arterial AE is detected.^{2,3} Combined with hyperbaric oxygen therapy if necessary, aspiration could thus be considered as a lifesaving therapeutic option.⁴

Acknowledgements

DdV is supported by a research grant from the Fundacion Alfonso Martin Escudero (Madrid, Spain).

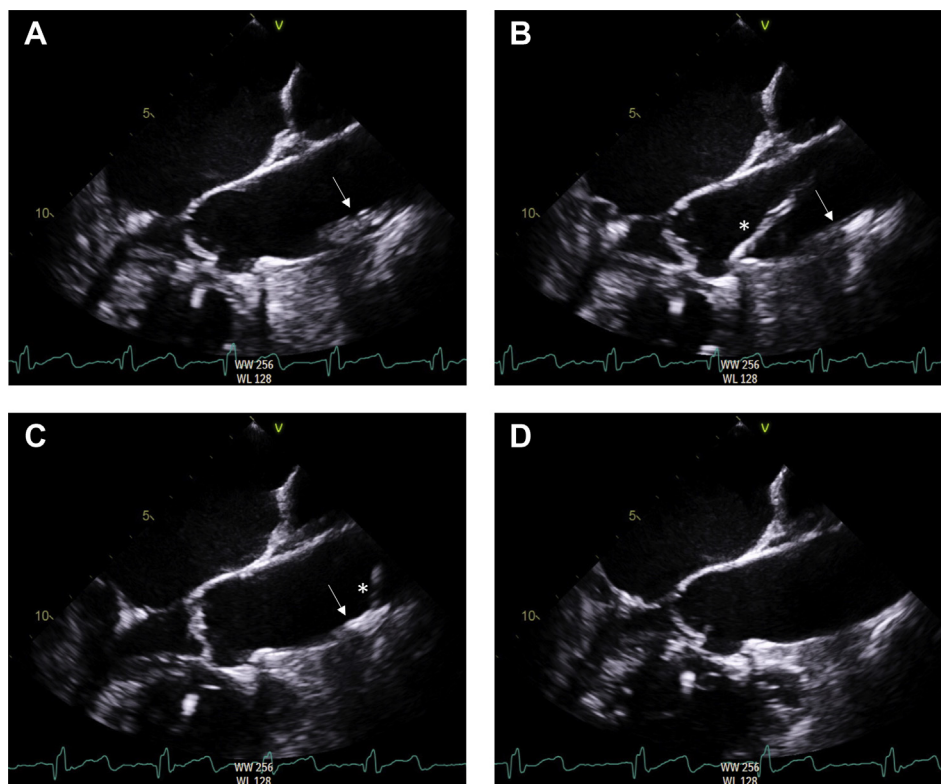


Figure 1. TEE detection of an air embolism (AE) and its management. TEE 3-chamber views showing the AE before, during, and after complete aspiration. (A) Substantial AE in the ascending aorta after delivery system removal (white arrow). (B, C) Precise suction of the AE with a Judkins right 6F catheter (white asterisk) under TEE guidance. (D) The ascending aorta free from the AE. TEE, transesophageal echocardiography.

Funding Sources

The authors have no funding sources to declare.

Disclosures

J.R.-C. holds the Canadian Research Chair “Fondation Famille Jacques Larivière” for the development of structural heart disease interventions. The rest of the authors have no conflicts of interest to disclose.

References

1. Bessereau J, Genotelle N, Chabbaut C, et al. Long-term outcome of iatrogenic gas embolism. *Intensive Care Med* 2010;36:1180-7.
2. Nielsen NE, Baranowski J, Boano G, Nylander E, Wallby L. Massive air embolism during MitraClip insertion. In: Feldman T, Franzen O, Low R, Rogers J, Yeo KK, eds. *Atlas of Percutaneous Edge-to-Edge Mitral Valve Repair*. London: Springer, 2013:519-20.
3. Debonnaire P, Droogmans S, Coussement P, et al. A breath of air during MitraClip valve repair [e-pub ahead of print]. *Acta Cardiol*. <https://doi.org/10.1080/00015385.2019.1639938>, accessed November 28, 2020.
4. Ziser A, Adir Y, Lavon H, Shupak A. Hyperbaric oxygen therapy for massive arterial air embolism during cardiac operations. *J Thorac Cardiovasc Surg* 1999;117:818-21.

Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at <https://www.cjopen.ca/> and at <https://doi.org/10.1016/j.cjco.2020.08.010>.