Atrial-esophageal fistula after atrial fibrillation ablation: a case report and literature review

Xinyu Wang, Hang Yin, Min Cao, Xiaojing Zhao, Qing Ye, Yujie Fu

Department of Thoracic Surgery, Renji Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China

Contributions: (I) Conception and design: Y Fu; (II) Administrative support: X Zhao, Q Ye; (III) Provision of study materials or patients: X Wang; (IV) Collection and assembly of data: H Yin, M Cao; (V) Data analysis and interpretation: X Wang; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Yujie Fu. Department of Thoracic Surgery, Renji Hospital, Shanghai Jiao Tong University School of Medicine, Building 7, 160 Pujian Road, Shanghai 200040, China. Email: richardjiejie@hotmail.com.

Background: Atrial-esophageal fistula (AEF) is a rare, but high mortality, complication after catheter ablation. At present, there is no standard treatment for AEF. In this article, we introduce the treatment process of a case diagnosed with AEF and review the latest treatment progress of AEF.

Case Description: A 65-year-old man, who received catheter ablation 2 weeks prior, presented with fever, chills, and loss of consciousness. Blood cultures grew *Streptococcus viridans*. A computed tomography (CT) scan of the brain showed a large area of left craniocerebral infarction and air emboli in the right lobe. The chest CT demonstrated air between the left atrium and esophagus, as well as pericardial effusions. Gastroscopy showed an esophageal fistula 35 cm away from the incisor teeth. The patient was diagnosed with AEF, sepsis, and cerebral infarction. An urgent surgical operation and supportive treatments were performed after diagnosis. Eventually, he died of sepsis and multiple organ failure 24 days after surgery.

Conclusions: We have reported the treatment process of one case diagnosed with AEF and reviewed the latest treatment progress. AEF is a rare but lethal complication after catheter ablation. At present, austere challenges exist in the diagnosis and treatment of AEF. Repeat chest and head CT/magnetic resonance imaging (MRI) are essential for the identification of abnormal manifestations. In terms of treatment, urgent surgical repair is currently recommended once AEF is diagnosed. More attention should be paid to this complication.

Keywords: Atrial fibrillation (AF); catheter ablation; atrial-esophageal fistula (AEF); case report

Submitted Dec 06, 2022. Accepted for publication Jan 06, 2023. Published online Jan 31, 2023.
doi: 10.21037/atm-22-6570
View this article at: https://dx.doi.org/10.21037/atm-22-6570

Introduction

In recent years, the incidence of atrial fibrillation (AF) has been growing with the aging of the population. The treatment of AF mainly includes antiarrhythmic drugs and surgery (1). Catheter ablation, as a new technology of surgery, has become one of the main methods to treat AF due to its advantages of less trauma, low recurrence rate, and high success rate (2). Meanwhile, the related complications of catheter ablation have been gradually increasing. Atrial-esophageal fistula (AEF) is a rare, but high mortality, complication after catheter ablation. The anatomic proximity between the esophagus and the left atrium and thermal injury during the process of catheter ablation are responsible for AEF (3). At present, there is no standard treatment for AEF. In this article, we introduce the treatment process of a case diagnosed with AEF and review the latest treatment progress of AEF. We present the following case in accordance with the CARE reporting checklist (available at https://atm.amegroups.com/article/

view/10.21037/atm-22-6570/rc).

Case presentation

A 65-year-old man who presented with fever and chills without obvious incentives was admitted to emergency room. During the process of consultation, he suddenly experienced loss of consciousness, showing no response to any physical stimulation. The muscle strength of right limb was grade 0 whereas muscle strength of left limb was grade 2. The Babinski's sign was positive on the right lower limb. Blood examination revealed a leukocyte count of 17.5×10^9/L, neutrophil count of 16.28×10^9/L (93.3%), and C-reactive protein (CRP) count of 84.29 mg/L. His blood cultures grew *Streptococcus viridans*. No abnormalities were found in electrocardiogram and myocardial infarction markers. A hospital system review revealed that the patient had received catheter ablation 2 weeks before presentation due to refractory AF. A computed tomography (CT) scan of the brain showed a large area of left craniocerebral infarction, as well as several air emboli in the right lobe (*Figure 1A*). Chest CT demonstrated air between the left atrium and esophagus, as well as pericardial effusions (*Figure 1B*). The patient was diagnosed with AEF, sepsis, and cerebral infarction.

An urgent surgical operation was performed after diagnosis. Intraoperative gastroscopy showed an esophageal fistula 35 cm away from the incisor teeth, covered with fresh blood (*Figure 2A*). A standard posterolateral thoracotomy was adopted. Surgical exploration revealed dense adhesions between the lower esophagus at the level of the inferior pulmonary vein and the pericardium, indicating the presence of fistula (*Figure 2B*). The posterior pericardium was carefully opened longitudinally. The necrotic tissues above the fistula dropped when separating the left atrium and the esophagus, resulting in massive bleeding. A 1 cm-diameter defect in the posterior wall of the left atrium was found after controlling the bleeding. A 4-0 Prolene suture and autologous pericardial tissue were used to close the bleeding point and fistula immediately. A 3-incision esophagectomy and simultaneous anastomosis were performed to repair the esophagus due to large fistula and severe edema on the esophagus. Postoperatively, he received intensive care unit (ICU) monitoring, anti-infection administration, nutritional support, anticoagulation, and other supportive treatments. Eventually, he died of sepsis and multiple organ failure 24 days after surgery.

All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

Highlight box

Key findings

- This study reports the treatment process of one case diagnosed with atrial-esophageal fistula (AEF) and reviews the latest treatment progress.

What is known and what is new?

- AEF is a rare, but high mortality, complication after catheter ablation. At present, there is no standard treatment for AEF.
- This study reviews the latest treatment progress of AEF and provides the best treatment strategy for the moment.

What is the implication, and what should change now?

- AEF, as a rare complication after catheter ablation, should be paid to more attention in clinical practice. In terms of treatment, surgical repair is currently recommended once AEF is diagnosed.

Discussion

AEF is an extremely rare complication after catheter ablation, with an incidence of less than 0.1–0.25%. The proximity between the esophagus and the left atrium underlies the anatomic cause of AEF; only thin fatty tissues exist at the point of closest distance in between. Thermal injury, gastroesophageal reflux, and esophageal dysmotility are potential injury mechanisms of AEF, among which thermal injury plays the leading role in this process (3). Thermal injury could result in ulceration of the esophagus and subsequently form the fistula from the esophagus towards the left atrium.

AEF usually occurs around 21 days after the catheter ablation, ranging from 0 to 60 days. The severity of clinical symptoms mainly depends on the extent of the damage to the esophagus and left atrium. The most common symptoms are fever (81.6%), neurological abnormity (59.5%), chest discomfort (33.68%), and hematemesis (32.11%) (4).

AEF usually manifests non-specific symptoms and thereby is prone to misdiagnosis, with an early diagnosis rate of 35% (5). For patients with suspected AEF, blood routine and blood culture could reveal the infection of

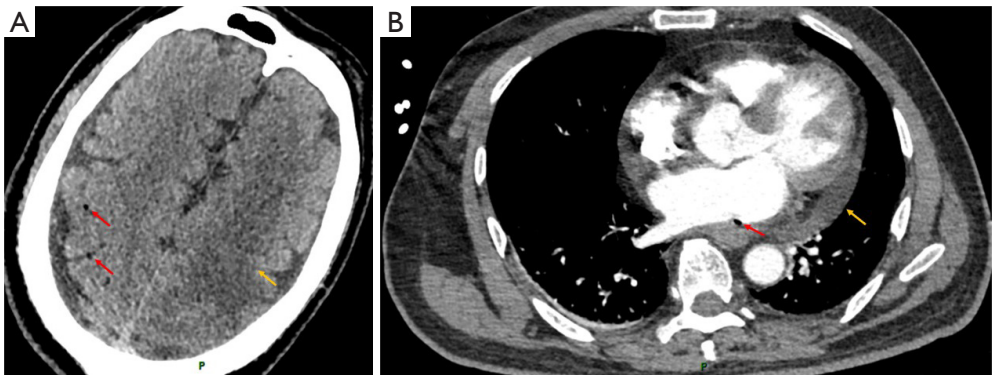

Figure 1 Imaging of atrial-esophageal fistula on brain and chest CT. (A) Brain CT showed a large area of left craniocerebral infarction (red arrow) and air emboli in the right lobe (yellow arrow). (B) Chest CT demonstrated air between the left atrium and esophagus (red arrow), as well as pericardial effusions (yellow arrow). CT, computed tomography.

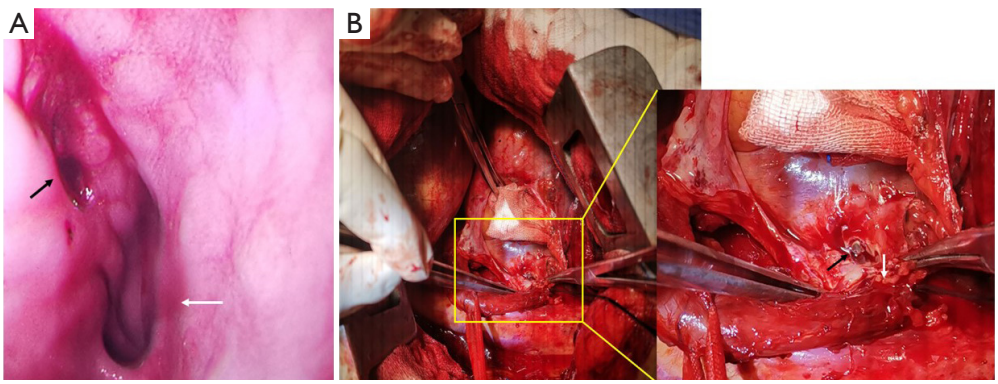

Figure 2 Intraoperative finding of atrial-esophageal fistula. (A) An esophageal fistula (black arrow) was seen on upper gastrointestinal endoscopy. White arrow represents the normal esophageal mucosa. (B) After separating the left atrium and esophagus, the atrial fistula (black arrow) and esophageal fistula (white arrow) were exposed.

the body. Initial chest CT or magnetic resonance imaging (MRI) is currently the most important imaging tool for diagnosing AEF, with the rates of abnormal manifestations exceeding 80%. Moreover, abnormal findings could be observed in more than 90% of repeat chest CT for those with normal findings on initial chest CT (4,5). Abnormal performances of chest CT contain mediastinal free air, pericardial effusion, thickening or thrombus of left atrium, fistula, or perforation of esophagus (4). In addition, 50% of patients may have unnormal findings on head CT or MRI, such as diffuse air embolism, ischemia, or infarction. Gastroscopy could reveal esophageal damage, bleeding, or perforation. However, caution is recommended for the use of upper gastroscopy when AEF is highly suspected because the insufflation process of the esophagus may exacerbate the danger of air embolism (6). In this patient, we performed gastroscopy for the identification of AEF and formulated the following surgical proposal. Nevertheless, the potential risk may outweigh the benefit, which is a limitation in the rescue process.

There are no standard surgical procedures for treating AEF. The current treatment mainly includes conservative therapy, esophageal stent, and surgical repair. Although there are accidental successful reports, most cases of conservative treatment and esophageal stenting alone have a mortality rate of nearly 100%, which is not advocated by the present evidence. Urgent surgical repair is currently the most effective way to treat AEF, with a success rate of 59%. Therefore, surgical repair is widely recommended. Surgery should be performed as soon as possible once diagnosed, and delayed intervention may exacerbate the disease (7).

Surgical repair includes the repair of both the left

atrium and esophagus. A standard sternotomy is used for intracardiac repair of the left atrium and posterolateral thoracotomy is suitable for esophageal repair. Normally, cardiopulmonary bypass (CPB) is necessary for intracardiac repair of the left atrium (8). Under CPB, it is safe and effective to incise the atrial wall and remove the necrotic tissue, thrombus, and debris. For small atrial fistulae (<5 mm), a 4-0 Prolene suture is sufficient for repair. For larger fistulae, a pericardial patch should be used for repair (9). Intracardiac repair under CPB could effectively prevent ongoing cerebral embolism caused by air emboli and potential massive bleeding. However, the repair of the atrium followed by esophageal repair requires a combination of thoracotomy and sternotomy, which increases the surgical trauma. In addition, the heparinization of CPB may increase the risk of cerebral hemorrhage during the surgery. Chen *et al.* circularly cut the left atrium and completely removed the atrial posterior wall. After that, the posterior pericardium was vertically opened to visualize and mobilize the esophagus (10). In this way, it is possible to repair the left atrium and esophagus through sternotomy completely. However, visualization of the esophagus under this position may be insufficient compared with standard posterolateral thoracotomy. The off-pump approach permits simultaneous repair of the atrium and esophagus via posterolateral thoracotomy. It may be beneficial for critically ill patients, especially for those with hemodynamic instability, which is recommended by some surgeons (11,12). At present, there are no randomized controlled trials to compare the postoperative outcomes between intracardiac and extracardiac approach. In general, intracardiac repair under CPB may be safer by preventing ongoing cerebral embolism and massive bleeding. Therefore, femoral arterial and venous cannulation is suggested to be routinely prepared to facilitate urgent CPB in case of uncertain risk.

Esophageal repair is also an important part of surgery by reducing mediastinal infection caused by continuous leakage of esophageal contents. During the operation, the esophagus is thoroughly mobilized around the fistula and repaired in 2 layers with absorbable sutures. An intercostal muscle, omentum, or pericardium is wrapped around the repair site to help prevent the recurrence of fistula (7). For large fistulas caused by the close adhesion of the pericardium and esophagus, esophagectomy is inevitable. Simultaneous or delayed reconstruction mainly depends on the health status of the patient and the degree of mediastinal contamination. For critically ill patients or those with severe mediastinal contamination, esophageal excision and delayed reconstruction is appropriate (9). In this patient, we performed the esophagectomy and simultaneous reconstruction based on the patient's good health status, resulting in extensive surgical invasiveness that was unfavorable for postoperative recovery. Simple esophageal repair and delayed reconstruction may be more beneficial under such circumstances. This is another shortcoming in the surgical process.

Prevention is extremely important in view of the unsatisfying outcome of treatment. During the process of catheter ablation, monitoring the position of the catheter, developing esophageal cooling systems, and setting the target values may help to reduce intraoperative esophageal injury, thereby reducing the occurrence of AEF (3).

Conclusions

In conclusion, austere challenges exist in the diagnosis and treatment of AEF currently. Repeat chest and head CT/MRI are essential for discovering abnormal manifestations. In terms of treatment, surgical repair is currently recommended once AEF is diagnosed. Repair method should depend on the actual situation during the surgery. In addition, postoperative supportive treatments are also extremely critical. More attention should be paid to this complication after catheter ablation.

Acknowledgments

Funding: None.

Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at https://atm.amegroups.com/article/view/10.21037/atm-22-6570/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://atm.amegroups.com/article/view/10.21037/atm-22-6570/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research

committee(s) and with the Declaration of Helsinki (as revised in 2013). Written informed consent was provided by the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

References

1. Zou T, Chen Q, Chen C, et al. Moricizine prevents atrial fibrillation by late sodium current inhibition in atrial myocytes. J Thorac Dis 2022;14:2187-200.
2. Parameswaran R, Al-Kaisey AM, Kalman JM. Catheter ablation for atrial fibrillation: current indications and evolving technologies. Nat Rev Cardiol 2021;18:210-25.
3. Kapur S, Barbhaiya C, Deneke T, et al. Esophageal Injury and Atrioesophageal Fistula Caused by Ablation for Atrial Fibrillation. Circulation 2017;136:1247-55.
4. Liu A, Lin M, Maduray K, et al. Clinical Manifestations, Outcomes, and Mortality Risk Factors of Atrial-Esophageal Fistula: A Systematic Review. Cardiology 2022;147:26-34.
5. Ha FJ, Han HC, Sanders P, et al. Challenges and limitations in the diagnosis of atrioesophageal fistula. J Cardiovasc Electrophysiol 2018;29:861-71.
6. Sylvin EA, Jassar AS, Kucharczuk JC, et al. Pericardial-Esophageal Fistula: A Rare but Increasing Complication of Cardiac Ablation. Thorac Cardiovasc Surg Rep 2022;11:e27-9.
7. Singh SM, d'Avila A, Singh SK, et al. Clinical outcomes after repair of left atrial esophageal fistulas occurring after atrial fibrillation ablation procedures. Heart Rhythm 2013;10:1591-7.
8. Hartman AR, Glassman L, Katz S, et al. Surgical repair of a left atrial-esophageal fistula after radiofrequency catheter ablation for atrial fibrillation. Ann Thorac Surg 2012;94:e91-3.
9. Gray WH, Fleischman F, Cunningham MJ, et al. Optimal Approach for Repair of Left Atrial-Esophageal Fistula Complicating Radiofrequency Ablation. Ann Thorac Surg 2018;105:e229-31.
10. Chen LW, Chen JY, Fang GH, et al. Novel Approach for Repair of a Left Atrial Esophageal Fistula After Radiofrequency Ablation. Ann Thorac Surg 2021;111:e205-7.
11. Khandhar S, Nitzschke S, Ad N. Left atrioesophageal fistula following catheter ablation for atrial fibrillation: off-bypass, primary repair using an extrapericardial approach. J Thorac Cardiovasc Surg 2010;139:507-9.
12. Shimamura J, Moussa F, Tarola C, et al. Surgical Repair of Atrial-Esophageal Fistula Following Catheter Ablation. Ann Thorac Surg 2022;113:e275-8.

(English Language Editor: J. Jones)

Cite this article as: Wang X, Yin H, Cao M, Zhao X, Ye Q, Fu Y. Atrial-esophageal fistula after atrial fibrillation ablation: a case report and literature review. Ann Transl Med 2023;11(2):138. doi: 10.21037/atm-22-6570