

Atrio-Oesophageal Fistula Following Pulmonary Vein Ablation

Smith, Warren

Atrio-oesophageal fistula is a rare complication of ablation procedures for atrial fibrillation (AF), which has proved fatal in most reported cases. An additional case to the limited number reported in the literature to date is described and the various issues associated with this feared complication discussed.

A 72 year old male with permanent AF was referred for a pulmonary vein isolation procedure. He had associated ischaemic heart disease, with prior myocardial infarctions in 1980 and 1981 and coronary artery bypass grafting in 1988. PAF developed in 2000, with a possible TIA. LV function was impaired with an ejection fraction of 40%. He was started on amiodarone and warfarin and after a second cardioversion maintained sinus rhythm for 5 years. In 2004 he had a drug eluting stent to distal LAD and in July 2005, a brainstem stroke with minor residual sensory deficit. AF recurred in 2006 and repeat cardioversion x3 was unsuccessful at maintaining sinus rhythm.

Because of a poor quality of life in AF he proceeded to a wide encircling ablation of the pulmonary veins with an irrigated catheter in December 2006. In addition, a roofline ablation was performed plus targeting of complex fractionated electrograms in LA. Finally a mitral isthmus ablation was performed, complicated by a "pop" and pericardial tamponade, managed percutaneously. He made an uncomplicated recovery, but was readmitted 25 days later with a one day history of fever and rigors, on a background of feeling non-specifically unwell for one week. Multiple seizures occurred and a CT chest scan showed mediastinal and intraventricular air. The diagnosis of an atrio-oesophageal fistula was made, but urgent surgery was not felt possible because of his shocked state and renal failure and he died about 24 hours later.

Atrio-oesophageal fistula had been reported in the surgical literature after intra-operative ablation;¹⁻³ the first 2 cases following a percutaneous procedure were reported by Pappone et al⁴ and at least a further 12 cases have been described (Table 1). However an unknown number of additional cases are likely to be presently unreported. There is usually a delay between ablation and presentation, from a few days to up to 25 days as in the case reported by Schley⁵ and this report.

Table 1

Author	Year	Age	Gender	Signs of Inflammation	Cerebral Embolism	Outcome	Time to Presentation (days)
Pappone ⁴	2004	36	M	Yes	Yes	Survived	3
		59	M	Yes	Yes	Died	2
Scanavacca ¹¹	2004	72	M	Yes	Yes	Died	20
Cummings ¹²	2006	?	4/9M	9/9	8/9	9/9 Died	Mean 12
Bunch ¹³	2006	48	M	Yes	No	Survived	14
Schley ⁵	2006	37	M	Yes	Yes	Died	25

This suggests delayed necrosis, possibly from damage to the oesophageal arterial supply as well as direct thermal injury. There also seems to be a valve-like mechanism permitting recurrent air embolism rather than fatal haemorrhage in the majority of reported cases to date.

Both clinical and autopsy studies have documented the close association of the oesophagus and the posterior left atrium. Lemola et al,⁶ using 3D reconstruction from helical chest CT scans, report the mean length of the oesophagus in contact with the posterior LA to range from 23 to 97mm (mean 58±14) In just over half of the 50 patients they studied, the oesophagus was located to the left of the midline of the posterior LA wall, in a third it was oblique and in 6% it was to the right side. A similar study by Monnig et al.⁷ in 60 males again noted high variability between the relationship of the oesophagus and the pulmonary veins, most often being close to the ostia of those on the left.

Both studies noted the presence of a fat pad between the oesophagus and the posterior left atrium, although it is not continuous in up to 50% of patients. However the Michigan group⁸ have noted that the oesophagus is mobile and dynamic shifts during the ablation procedure of 2 cm or more occur in a majority of patients. They emphasized therefore the importance of real-time imaging during a procedure rather than reliance on a pre-study image performed hours or days before ablation. In a study on 15 cadavers,⁹ reported the mean oesophageal wall thickness to be 2.5 ± 1

mm, with variable thickness of the posterior LA wall, being thickest adjacent to the coronary sinus and thinnest more superiorly (from 6.5 ± 2.5 mm to 2.5 ± 0.5 mm respectively. Of concern, they also noted that injury was possible with encirclement of the vein orifices themselves without necessarily making lines across the posterior LA.

In the study by Lemola et al,⁶ there were no demographic or clinical predictors of the size of the fat pad or thickness of the atrial or oesophageal walls. In about a quarter of their cases the shortest oesophagus-to-LA distance was where the oesophagus crossed from left to right over a vertebral body.

Monitoring luminal oesophageal temperature is not necessarily predictive of intramural temperatures. In the study by Cummings et al¹⁰ power settings were a weak predictor of oesophageal temperature, but the presence of micro bubbles near the oesophagus was more strongly predictive of injury. Restricting power with the appearance of micro-bubbles could avoid oesophageal damage.

At present therefore, it would appear there is no guaranteed strategy to eliminate the risk of possible oesophageal damage and subsequent fistula formation. Lower generator settings of 50 W and 55 C, superior placement of the transverse posterior line and some monitoring of oesophageal position and temperature would seem prudent, but further refinement of lesion sets is desirable to reduce risk. A high index of suspicion should exist if fever or signs of inflammation develop post ablation with immediate CT imaging and urgent surgical repair before disastrous air embolism nullifies benefit. Oesophageal stenting as an emergency procedure has been emphasized as contraindicated because of the risks of massive systemic air embolism.¹¹

References

- 1 Gillinov AM, Pettersson G, Rice TW. Esophageal injury during radiofrequency ablation for atrial fibrillation. *J Thorac Cardiovasc Surg* 2001; **122**: 1239-40.
- 2 Mohr FW, Fabricius AM, Falk V, et al. Curative treatment of atrial fibrillation with intraoperative radiofrequency ablation: short-term and midterm results. *J Thorac Cardiovasc Surg* 2002; **123**: 919-27.
- 3 Sonmez B, Demirsoy E, Yagan N, et al. A fatal complication due to radiofrequency ablation for atrial fibrillation: atrio-esophageal fistula. *Ann Thorac Surg* 2003; **76**: 281-83.
- 4 Pappone C, Oral H, Santinelli V, et al. Atrio-esophageal fistula as a complication of percutaneous transcatheter ablation of atrial fibrillation. *Circulation* 2004; **109**: 2724-26.
- 5 Schley P, Gulker H, Horlitz M. Atrio-oesophageal fistula following circumferential pulmonary vein ablation: verification of diagnosis with multislice computed tomography. *Europace* 2006; **8**: 189-90.
- 6 Lemola K, Sneider M, Desjardins B, et al. Computed tomographic analysis of the anatomy of the left atrium and the esophagus: implications for left atrial catheter ablation. *Circulation* 2004; **110**: 3655-60.
- 7 Monnig G, Wessling J, Juergens KU, et al. Further evidence of a close anatomical relation between the oesophagus and pulmonary veins. *Europace* 2005; **7**: 540-45.
- 8 Good E, Oral H, Lemola K, et al. Movement of the esophagus during left atrial catheter ablation for atrial fibrillation. *J Am Coll Cardiol* 2005; **46**: 2107-10.
- 9 Sanchez-Quintana D, Cabrera JA, Climent V, et al. Anatomic relations between the esophagus and left atrium and relevance for ablation of atrial fibrillation. *Circulation* 2005; **112**: 1400-05.
- 10 Cummings JE, Schweikert RA, Saliba WI, et al. Assessment of temperature, proximity, and course of the esophagus during radiofrequency ablation within the left atrium. *Circulation* 2005; **112**: 459-64.
- 11 Scanavacca MI, D'avila A, Parga J, Sosa E. Left atrial-esophageal fistula following radiofrequency catheter ablation of atrial fibrillation. *J Cardiovasc Electrophysiol* 2004; **15**: 960-62.
- 12 Cummings JE, Schweikert RA, Saliba WI, et al. Brief communication: atrial-esophageal fistulas after radiofrequency ablation. *Ann Intern Med* 2006; **144**: 572-74.
- 13 Bunch TJ, Nelson J, Foley T, et al. Temporary esophageal stenting allows healing of esophageal perforations following atrial fibrillation ablation procedures. *J Cardiovasc Electrophysiol* 2006; **17**: 435-39.