High-risk transseptal puncture in a patient with a “pancake” deformity in the left atrium caused by descending aorta displacement

Takuro Nishimura, MDa, Seiji Fukamizu, MDa,*, Noriko Matsushita, MDa, Rintaro Hojo, MDa, Takekuni Hayashi, MDa, Tomomi Abe, MDa, Kota Komiyama, MDa, Yasuhiro Tanabe, MDa, Tamotsu Tejima, MD, PhDa, Harumizu Sakurada, MD, PhDb, Mitsuhiro Nishizaki, MD, PhDc, Masayasu Hiraoka, MD, PhDc

a Department of Cardiology, Tokyo Metropolitan Hiroo Hospital, 2-34-10 Ebisu Shibuya-ku, Tokyo 150-0013, Japan
b Department of Cardiology, Yokohama Minami Kyosai Hospital, Japan
c Tokyo Medical and Dental University, Japan

Article info
Article history:
Received 27 January 2012
Received in revised form 1 March 2012
Accepted 11 March 2012
Available online 23 May 2012

Keywords:
Atrial fibrillation
Catheter ablation
Brockenbrough Imaging

Abstract
Catheter ablation via the transseptal approach has recently become a widely performed technique for treating atrial fibrillation (AF). However, fluoroscopic imaging provides limited anatomic guidance for the left atrial structure. We describe the case of a 78-year-old man who was referred to our hospital for pulmonary vein isolation for symptomatic paroxysmal AF. He had a history of pulmonary tuberculosis for which he had undergone a right upper lobectomy. A “pancake” deformity of the left atrium (LA) was observed using 64-slice multislice computed tomography. We performed a transseptal puncture by using real-time three-dimensional transesophageal echocardiography (RT3D-TEE) in combination with fluoroscopic imaging, without any complications. Although transseptal puncture can be performed without echocardiographic guidance in most patients, in our patient, RT3D-TEE proved to be a very helpful imaging technique to access the LA.

1. Introduction
Percutaneous catheter ablation is a valuable tool for the management of atrial fibrillation (AF). However, this technique requires access to the left atrium (LA), which is obtained by transseptal puncture. Real-time three-dimensional (3D) transesophageal echocardiography (RT3D-TEE) is a recently developed technique that provides 3D images of the heart [1]. Here, we report the case of a patient who required a high-risk transseptal puncture due to a “pancake” deformity of the LA and a displacement of the aorta; our results show that RT3D-TEE is very useful for this procedure.

2. Case report
A 78-year-old man was referred to our hospital for pulmonary vein isolation (PVI) for symptomatic paroxysmal AF. He had a history of pulmonary tuberculosis for which he had undergone a right upper lobectomy. Before the procedure, a “pancake” deformity of the LA was observed using a 64-slice multislice computed tomography (CT). This deformity was believed to be a complication of the right upper lobectomy. The descending aorta was in direct contact with the center of the posterior LA wall. The esophagus had descended to the level of the LA along the left side of the descending aorta. CT revealed an anteroposterior LA diameter of 16 mm (Fig. 1). This deformity could not be observed by transthoracic echocardiography. Transesophageal echocardiography revealed the “pancake” LA sandwiched by the ascending aorta and the descending aorta (Fig. 2A). Chest radiography revealed the displacement of the descending aorta (Fig. 2B). In most patients, we use only a fluoroscopically guided approach to the LA for a transseptal puncture. However, in this patient, we thought it would be difficult to approach the LA using our typical method due to the small atrial septum and the displacement of the aorta. After a detailed assessment, we planned to use RT3D-TEE in combination with fluoroscopic imaging for transseptal puncture. Before catheter ablation, the patient gave written informed consent for the procedure. We excluded the existence of a thrombus in the LA and appendage by transesophageal echocardiography.

In the cardiac catheterization room, the patient was sedated with propofol. Then, electrode catheters were placed in the...
coronary sinus from the right subclavian vein, in the right atrial appendage, and in the superior vena cava from the left femoral vein. A pressure line was inserted from the right femoral artery. A 60-cm 8-Fr transseptal sheath (FAST-CATH; St. Jude Medical, MN, USA), a 63-cm 8-Fr sheath (SLO; St. Jude Medical, MN, USA), and a 61-cm 8.5-Fr sheath (Agilis NxT; St. Jude Medical, MN, USA) were inserted over the wires from the right femoral vein. A RT3D-TEE probe (X7-2t TEE probe; Philips Medical System, Andover, MA) was inserted into the esophagus to the level of the LA. The patient did not seem uncomfortable during the probe insertion. RT3D-TEE permitted the accurate visualization of the fossa ovalis as well as the appreciation of the orientation of the Brockenbrough needle in 3 dimensions (Fig. 3). We positioned the Brockenbrough needle and the sheath in the superior vena cava; we then withdrew the system under RT3D-TEE and fluoroscopic imaging guidance and placed it in the fossa ovalis. No classic jump feeling into the fossa was experienced. We confirmed that the Brockenbrough needle was tenting in the fossa ovalis and carefully pushed the needle through to the LA. We confirmed that the needle was placed through the atrial septum (Fig. 3), and the RT3D-TEE probe was pulled out. The duration of RT3D-TEE was 18 min. Thereafter, PVI was performed successfully using the CATRO system (Fig. 4). After 3 day’s observation, the patient was discharged without complications.

3. Discussion

The technique of transseptal puncture that is commonly used today was originally described by Ross and Cope in 1959 and Brockenbrough and Braunwald in 1960 [2–4]. The complications of transseptal catheterization include inadvertent perforation of the heart or the surrounding vascular structures, which results in pericardial effusion and cardiac tamponade, and thromboembolism. Transseptal puncture can be performed without echocardiographic guidance in most patients. Tao et al. reported the case of a patient with straight back syndrome with concomitant AF, who underwent catheter ablation. A “pancake” deformity of the LA was found using 64-slice multislice CT and 3D reconstruction imaging. A transseptal puncture was performed 3 times under fluoroscopic guidance, but failed. Then, hand-injected contrast was detected in the pericardium and the subsequent ablation was canceled [5].

Here, we show that RT3D-TEE is a very helpful imaging technique to access the LA. Some reports have previously described that two-dimensional transesophageal echocardiography (2D-TEE) and intracardiac echocardiography (ICE) are useful for high-risk transseptal puncture [1,6]. Faletra et al. reported that RT3D-TEE may provide better guidance for transseptal puncture than 2D-TEE. Although 2D-TEE can help visualize the atrial septum in several planes, due to the “tomographic” nature of this technique, the planes always intersect the septum perpendicularly. Consequently, this structure is imaged as a linear echo, which may be thicker around the fossa ovalis (muscular rim) and thinner at the level of the floor. Moreover, the spatial relationship with the surrounding cardiac structures is difficult to appreciate because this technique lacks the third dimension. Tracking the intracardiac catheter and establishing its position relative to the fossa ovalis may be difficult with 2D-TEE because multiple views and continuous imaging adjustments are required. In contrast, KT-3D images of the atrial septum and surrounding atrial wall can be obtained by RT3D-TEE from any possible 2D angle [1]. Compared to TEE, ICE is an invasive tool that requires central venous access and provides only 2D imaging [7]. This case demonstrates the ability of RT3D-TEE to image relevant intracardiac landmarks during transseptal imaging, to provide immediate 3D feedback, and to effectively guide transseptal puncture. The disadvantage of TEE is that the probe may obscure the fluoroscopic view [8]. It is difficult to maintain the TEE probe in the esophagus for a long period in non-sedated or lightly sedated patients due to the considerable discomfort associated with the technique [6]. In this patient, we were able to perform...
the procedure in a short period, and the patient did not seem uncomfortable under sedation.

Nonaka et al. have described that the right diaphragm is greatly elevated, the left ventricle tends to move vertically, and the ascending aorta moves to the right side after a right upper lobectomy [9]. In this patient, it was unknown whether the right upper lobectomy resulted in the observed descending aorta displacement.

In this case, RT3D-TEE was successfully used in a patient with a high-risk “pancake” deformity of the LA after a right upper lobectomy; RT3D-TEE avoided possible serious complications during transseptal puncture.
Conflict of interest

The authors have no financial conflicts of interest to disclose concerning the paper.

References