Balloon Technologies for Atrial Fibrillation Ablation
— It Really Is a Hot Topic Now! —

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Atrial fibrillation (AF) is the most common tachyarrhythmia, associated with stroke, systemic embolism, and heart failure, leading to increased mortality. Catheter ablation is an effective therapeutic option to restore and maintain sinus rhythm in patients with AF, and it is being increasingly performed worldwide. Because most of the ectopic beats triggering AF arise from the pulmonary veins (PVs), PV isolation (PVI) is the cornerstone of AF ablation, and point-by-point radiofrequency catheter ablation (RFCA) around the PVs has been the mainstay of PVI. However, despite the development of 3D mapping systems and high-performance ablation catheters with an irrigation tip and contact force sensing technology, point-by-point RFCA remains a technically complex procedure. Thus, several balloon devices have been developed to realize simpler PVI procedure with less catheter manipulation at the target PVs.1,2

The cryoballoon was the first approved balloon device for PVI, and is now the most commonly used worldwide.1 The refrigerant N2O is delivered into the balloon where it undergoes a liquid-to-gas phase change, resulting in an inner balloon temperature of approximately −80°C. The 1st-generation device (Arctic Front™, Medtronic, MN, USA) became available in Europe in 2006 and was approved in the USA in 2011. A 2nd-generation device...
(Arctic Front Advance™, Medtronic) (Figure A) was approved simultaneously in Europe and the USA in 2012, and in Japan in 2014. For this cryoballoon, the refrigerant injection ports were doubled, and their positions were moved 4.5 mm more distal, which enabled more homogeneous freezing of the frontal hemisphere of the balloon. Two different diameters (23 and 28 mm) are available, although the smaller size is rarely used. Recording of PV potentials is available during freezing by a dedicated spiral mapping catheter. The acute PVI success using the 2nd-generation cryoballoon alone was reported to be 97.5–100% per PV and 90.5–100% per patient. Recently, 3 randomized clinical trials (RCTs) compared cryoballoon PVI vs. antiarrhythmic drug therapy as the first-line therapy of untreated AF. Cryoballoon PVI was associated with higher arrhythmia-free rates, improved quality of life, and less hospitalization without an increase in the risk of adverse events. Also, in several RCTs comparing 2nd-generation cryoballoon vs. point-by-point RFCA with contact force sensing catheter, cryoballoon PVI was associated with shorter procedure time and comparable rates of acute complications and mid- to long-term arrhythmia.