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Continuous RAPID-mode ablation with a third-generation laser balloon

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Laser balloon (LB) ablation is highly effective in achieving pulmonary vein isolation (PVI), and the safety and 12-month efficacy are comparable with current atrial fibrillation ablation technologies [1]. Understanding the properties of lesion formation with third-generation laser balloon (LB3) ablation using a motorized rotational delivery system (RAPID mode) with high power (13 W or 15 W) is essential for safe and reliable pulmonary vein isolation [2,3]. The reduction in total laser energy for PVI by RAPID-mode laser ablation can be expected to reduce the risk of pulmonary vein stenosis and collateral damage to the upper gastrointestinal tract.

Using LB3, Schmidt et al. [4] achieved a success rate of 98.1%, and compared to earlier laser versions, shorter procedure, left atrial dwell, and total laser times were observed. First-pass PVI was achieved with LB3 in 91.6% of cases. In our previous study, we described a high-power, short-duration ablation using LB, which may result in shorter procedure time and greater safety, without affecting clinical efficacy [5]. Rapid PVI with a continuous lesion is associated with a significant decrease in ablation and procedure times, while maintaining safety and chronic effectiveness.

Tohoku et al. [6] reported that continuous robotic LB3 ablation leads to higher index lesion durability than standard point-by-point laser ablation. Focal energy reduction was a predictor of PV reconnection, suggesting the importance of optimal visualization of the antrum using LB3. Therefore, we examined the characteristics of lesion formation using the continuous robotic-motor-driven RAPID-mode LB3. This study was approved by the Institutional Animal Use and Care Committee of the Intervention Technical Center, Narita, Japan, and was in compliance with the guidelines set forth by the Japanese Society for Laboratory Animal Resources. A swine weighing 44 kg was anesthetized with isoflurane and ventilated mechanically. The transseptal puncture to access the left atrium was performed using a radiofrequency energy-based transseptal needle (NRG^{TM} Transseptal Needle; Baylis Medical, ON, Canada) with a long sheath (Swartz^{TM} SL1^{TM}, Abbott, MN, US). The swine underwent PVI with an LB3 (HeartLight, X3; CardioFocus, MA, US) using 13 W in the RAPID mode as the maximum power setting for 180 s to complete the encirclement of the PV. There were no manual lesions delivered because the PVI was completed on the first attempt with a single sweep in the RAPID mode. Fluoroscopy during LB ablation of the LSPV and elimination of an intracardiac electrocardiogram of the pulmonary vein potentials are shown in Fig. 1 A and B. Bidirectional conduction block was confirmed after inserting a circular mapping catheter. After the procedure, the hogs were euthanized, and a transmural, continuous circular lesion was visually confirmed by examining the dissected specimens (Fig. 2A). The transverse section of the dissected specimen was evaluated and measured at 1.93 mm (Fig. 2B). Continuous RAPID-mode laser application created a transmural lesion, which had a different geometry than that described for point-by-point standard RF applications. The lesion was consistent throughout. With RAPID-mode LB3 ablation, the pulmonary vein orientation, shape, and size, may impact lesion transmurality and creation.

To the best of our knowledge, this is the first report to examine the continuous lesion characteristics of a high-power 13 W continuous

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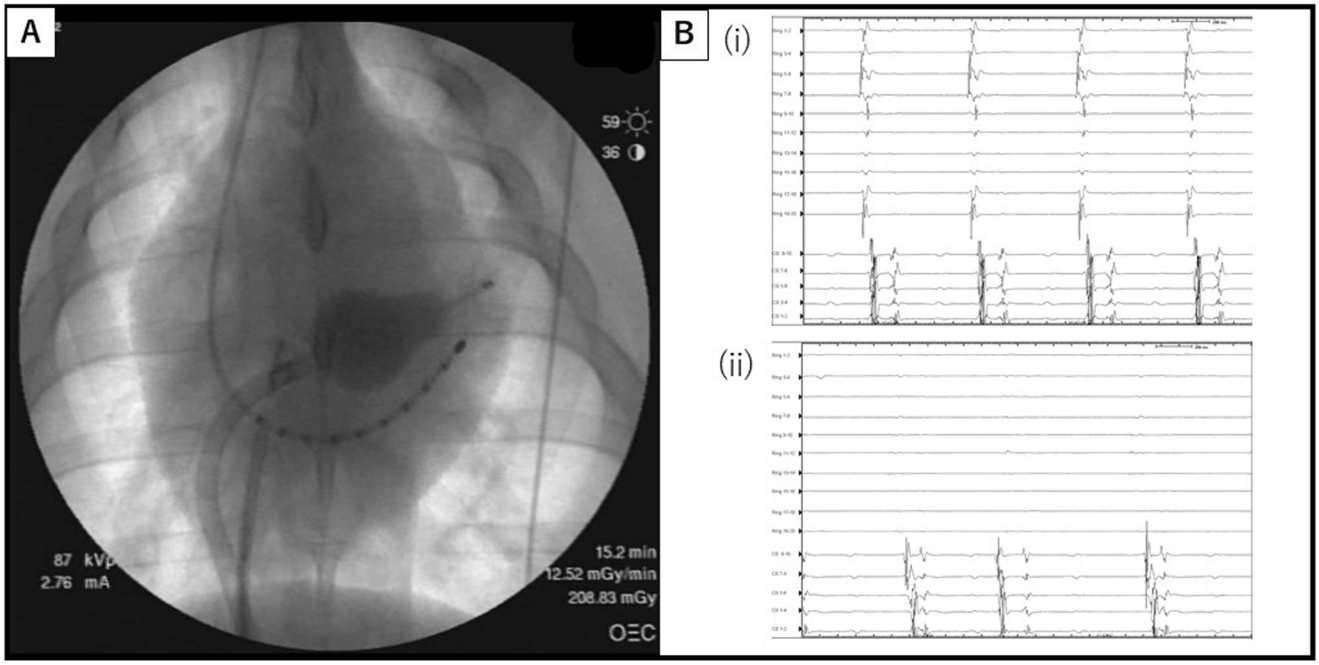

Fig. 1. Fluoroscopy during LB ablation of the LSPV. (A) Elimination of an intracardiac electrocardiogram of the pulmonary vein potentials. (B) Pre-ablation. (i) Post-ablation. (ii) LB, laser balloon; LSPV, left superior pulmonary vein.

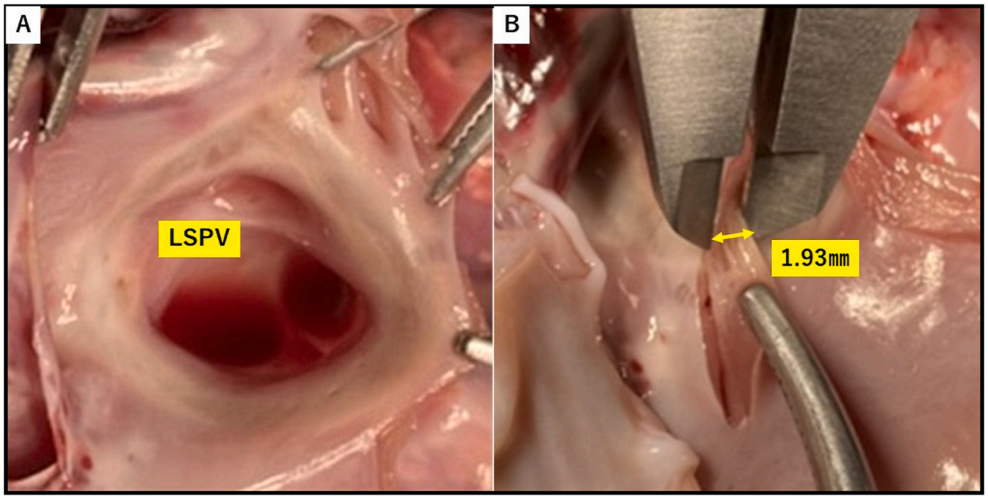

Fig. 2. Single shot laser balloon PVI ablation of the LSPV utilizing the X3 laser balloon. (A) After a circumferential 13 Watt 300 s RAPID-mode laser application, the LSPV was successfully isolated. (B) The transverse section of the dissected specimen was evaluated, and the actual measured value was 1.93 mm. (C) PVI, pulmonary vein isolation; LSPV, left superior pulmonary vein.

robotic laser ablation using the LB3. This procedure may result in decreased procedure time, improved safety, and more complete, durable, and transmural ablation lesions, resulting in improved clinical efficacy.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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