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SPOTLIGHT

Growing thrombus adhesion on the left atrial wall after catheter ablation of atrial fibrillation

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Catheter ablation eliminates atrial fibrillation (AF) and contributes to a reduction in the risk of thromboembolic events (TEs) as well as oral anticoagulant (OAC) use. On the other hand, the risk of TEs slightly increases after the ablation procedure, and periprocedural OAC use regardless of the risk for TEs is recommended. Periprocedural TEs include thrombus in the left atrial (LA) appendage, thrombus formation on the catheter, air embolisms during the procedure, and thrombus adhesion at the ablation site.[1] Here, we report a case of a growing and massive thrombus adhesion at the ablation site detected by contrast computed tomography (CT).

An 80-year-old Japanese man underwent radiofrequency catheter ablation of drug-refractory symptomatic paroxysmal AF. His renal function decreased (CCr 41 mL/min), but cardiac function evaluated by transthoracic echocardiography was almost normal (left ventricular ejection fraction = 66.8%, LA dimension = 38 mm). We performed a pulmonary vein (PV) isolation using an irrigated contact force-sensing catheter (THERMOCOOL SMARTTOUCH SF®, Biosense Webster, Inc.) with a CARTO® system under uninterrupted oral OAC use (Rivaroxaban 10 mg/day). Throughout the procedure, the activated clotting time was kept above 300 s by unfractionated heparin. The radiofrequency energy was applied in an Ablation Index-guided high-power short-duration manner (Figure 1A). With an irrigation flow of 15 mL/min, we applied 50 W of power at a contact force of 10–20 g for 8 s on the posterior wall of the left PVs, 50 W of power at a contact force of 10–30 g targeting Ablation Index of 550 on other regions of the PVs, and 35 W of power at the at a contact force of 10–30 g targeting Ablation Index of 550. To obtain a complete PV isolation and block of the LA roof line, numerous additional ablation applications were required. He was discharged without any complications or recurrent atrial tachyarrhythmias on postoperative day (POD) 2. No thrombus was detected in transthoracic echocardiography image on POD 1. On POD 8, he visited the emergency room with chest pain. A nongated contrast CT image demonstrated a complete filling defect, with a suspected thrombus, mainly on the LA posterior wall (Figure 1B,C). He experienced the first attack of an ischemic stroke the next day (Figure 1D). The OAC was changed to Dabigatran 220 mg/day after the first attack, although a second ischemic stroke attack with splenic infarcts occurred without recurrence of atrial tachyarrhythmias on POD 32. We also suspected a left atrial-esophageal fistula as a complication of ablation procedure due to recurrent TEs but since no mass was found on the esophagus, no air was detected in LA, and blood culture test was negative, we concluded that the thrombus formation was caused by hypercoagulability from inflammation of ablation. Thereafter, the thrombus continued to grow even under uninterrupted use of all OACs including warfarin up to POD 68 (Figure 1E–G; Video 1), resulting in a repeat ischemic stroke and systemic TEs (Figure 1H,I). Finally, he died from repeated TEs on POD 73.

The incidence of TEs increases especially within 2–4 weeks after ablation procedures,[2] and the risk of a thrombus adhesion at the ablation site has been experimentally confirmed in animal models.[1] To the best of our knowledge, this is the first report of a case with a growing thrombus adhesion at the ablation site on the posterior wall of the LA that was clearly seen on the contrast CT image, despite uninterrupted OAC use. The differentiation between recurrent thrombus formation/systemic embolism and left atrial-esophageal fistula after ablation procedure is difficult as they share many common symptoms such as thrombosis, signs of inflammation, and fever.[3] However, in this case, from negative blood culture test and no findings of fistula on

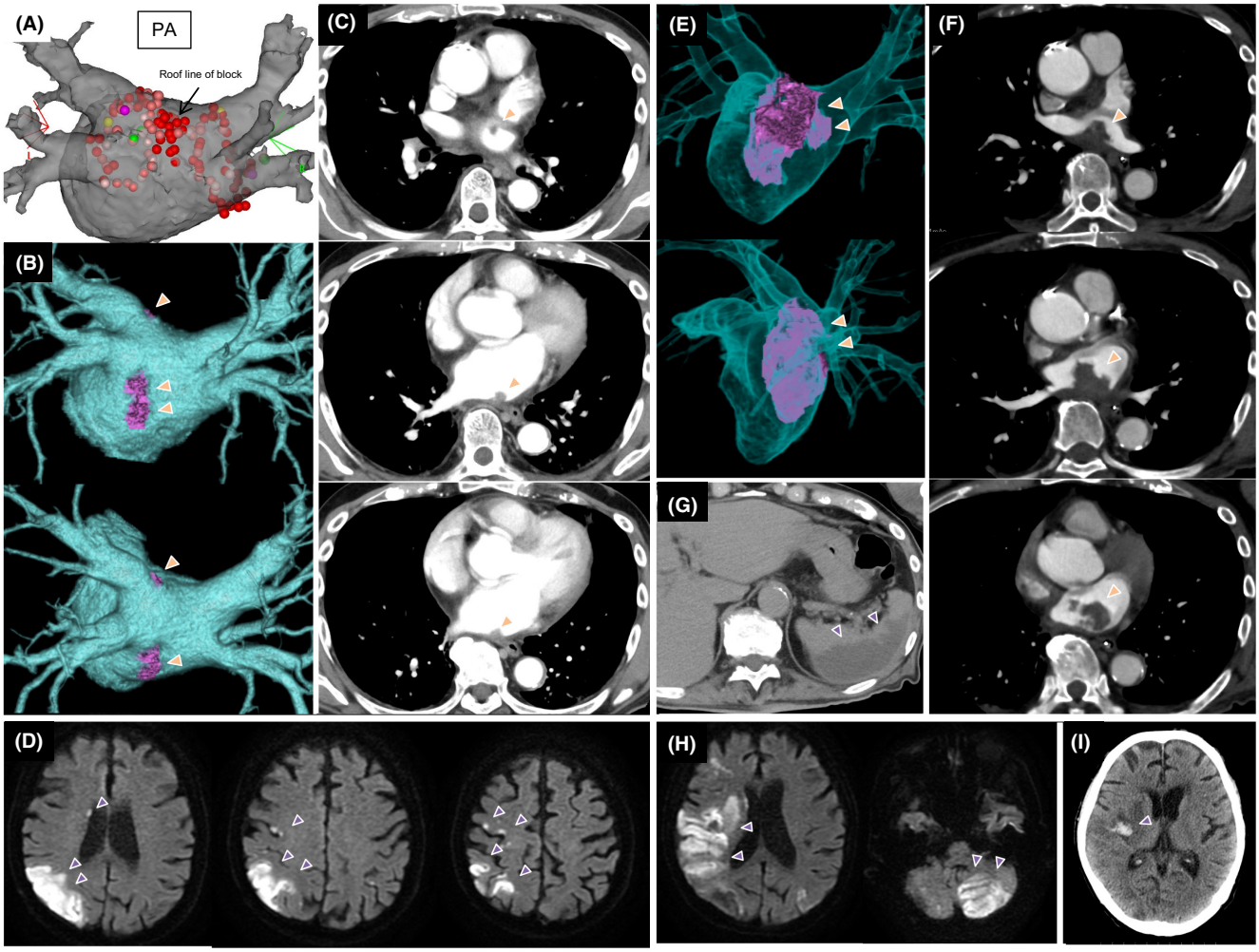
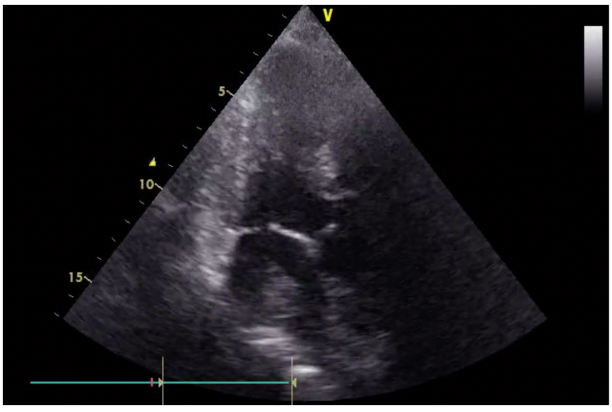


FIGURE 1 Growing thrombus in the left atrium detected by contrast CT after the ablation procedure. (A) A 3D-left atrial CT image and ablation tag (pulmonary vein isolation and left atrial roof line block). (B and C) The first thrombus detection by a nongated contrast CT image on POD 8. (D) The first stroke event on the POD 9 diffusion MRI image. (E and F) Massive thrombus adhesion on the left atrial posterior wall detected by electrocardiographic-gated contrast CT on POD 68. (G) Severe splenic infarcts. (H) The fourth stroke event causing severe quadriplegia on POD 67. (I) Hemorrhagic cerebral infarction causing a disturbance of consciousness on POD 77. Orange arrow: filling defect of the contrast suspected thrombus adhesion. Purple arrow: severe systemic embolism including splenic infarcts and a stroke. AP, Antero-posterior view.



VIDEO 1 To view this video in the full-text HTML version of the article, please visit https://onlinelibrary.wiley.com/doi/10.1002/joa3.12849.

imaging, we concluded that the thrombus formation was caused by hypercoagulability from inflammation of ablation. From the location of the adhesion, the thrombus adhesion was associated with numerous radiofrequency ablation applications applied due to difficulty in creating a complete block of the LA roof line. The high-power ablation allows for shorter application times compared to the conventional moderate-power ablation without increase of complications including TEs, but concerns about the shallower lesion depth have been raised.[4,5] In the current study, LA roof line ablation was performed at a moderate power of 35 W, taking into account epicardial connections, but resulted in difficulties. Although this difficulty is often seen in daily clinical practice and is caused by epicardial connections such as the septopulmonary bundle,[6] thrombus formation is not normally observed at the ablation site under periprocedural OACs. The OAC-refractory growing thrombus in this patient may have been caused by not only endocardial injury but also local hypercoagulability.

Regarding OAC as a cause or treatment of thrombus on LA, rivaroxaban 10 mg/day is recommended dose for Japanese patients with nonvalvular AF and coexisting decreased renal function. However, among the OAC available in Japan, it is the only one with a lower recommended dosage for Japanese AF patients than for those abroad. In this case, a dose of Rivaroxaban 10 mg/day during the ablation perioperative period may have been an underdose, and other OACs that were started later may have been ineffective enough to dissolve the thrombus. Anyway, all OACs including warfarin were unable to dissolve the thrombus, so it might have been appropriate to choose surgical procedures such as thrombus removal and/or repair of the ablation area. However, in this case, the timing of the surgery was very difficult to determine, considering the slowly enlarging thrombus and the repeat TEs that lead to a decrease in activities of family living. The detailed mechanism of local hypercoagulability in this case is unknown, but once it develops into resistance to OAC, treatment becomes difficult. Therefore, it is important to minimize the number of ablation application as much as possible and to minimize postoperative inflammation to avoid inducing local hypercoagulability.

In conclusion, we reported a case representing massive and growing thrombus adhesion even under uninterrupted OACs after ablation procedure.

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CONFLICT OF INTEREST STATEMENT

Authors declare no conflict of interests for this article.

DATA AVAILABILITY STATEMENT

All relevant data are within the manuscript.

ETHICS STATEMENT

The current study protocol was approved by the institutional review board of Mitsubishi Memorial Kyoto Hospital (E18-10).

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