Cost-Effectiveness Analysis of Pulsed Field Ablation versus Radiofrequency Ablation and Cryoablation for Paroxysmal Atrial Fibrillation in China

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OBJECTIVES

To evaluate the cost-utility of pulsed field ablation compared with radiofrequency ablation and cryoablation, respectively, in Chinese patients with paroxysmal atrial fibrillation.

METHODS

Patients with paroxysmal atrial fibrillation at different levels of atrial arrhythmia (AA) burden (<0.1%, 0.1-9.9%, ≥10%) may experience various AA burden states after undergoing ablation. A decision tree model was developed to simulate this process from a healthcare perspective, where patients could undergo a repeat ablation or experience a non-fatal stroke. Transition probabilities, clinical outcome and quality of life data were obtained from published sources and confirmed by expert physicians. Cost data were estimated from a survey of clinicians at tertiary hospitals, based on actual clinical practices. The uncertainty of results was explored through one-way sensitivity analysis and probabilistic sensitivity analysis by Monte Carlo simulation.

RESULTS

Compared with radiofrequency ablation (RFA) and cryoablation, pulsed field ablation (PFA) dominates both in incremental quality-adjusted life years (QALYs) gained and cost savings, assuming identical direct costs for ablation procedure.

Pulsed field ablation saved ¥2,408 (¥69,702 vs. ¥72,110) and gained 0.0161 more QALYs (0.8607 vs. 0.8446) than radiofrequency ablation. This includes savings of ¥323 in post-operative complication management, ¥1,558 in repeat ablation surgery costs weighted by the number of procedures, and ¥506 in long-term medication costs for antiarrhythmic and anticoagulants.(Table 1)

Table 1 Results of base case cost-effectiveness analysis (PFA vs. RFA)

	Ablation Methods		
	PFA	**RFA**	**Incremental**
Total costs	**¥72,702.4**	**¥72,110.3**	**¥592.1**
Ablation procedure cost	¥68,000.0	¥65,000.0	¥3,000.0
Weighted post-ablation complication-related costs	¥95.3	¥418.5	¥-323.1
Weighted redo ablation costs	¥1,769.3	¥3,327.6	¥-1,558.4
Weighted non-fatal stroke-related costs	¥55.2	¥76.1	¥-20.8
Weighted continued use of AADs and anticoagulants costs	¥2,782.6	¥3,288.1	¥-505.5
Total QALYs	**0.859**	**0.842**	**0.017**

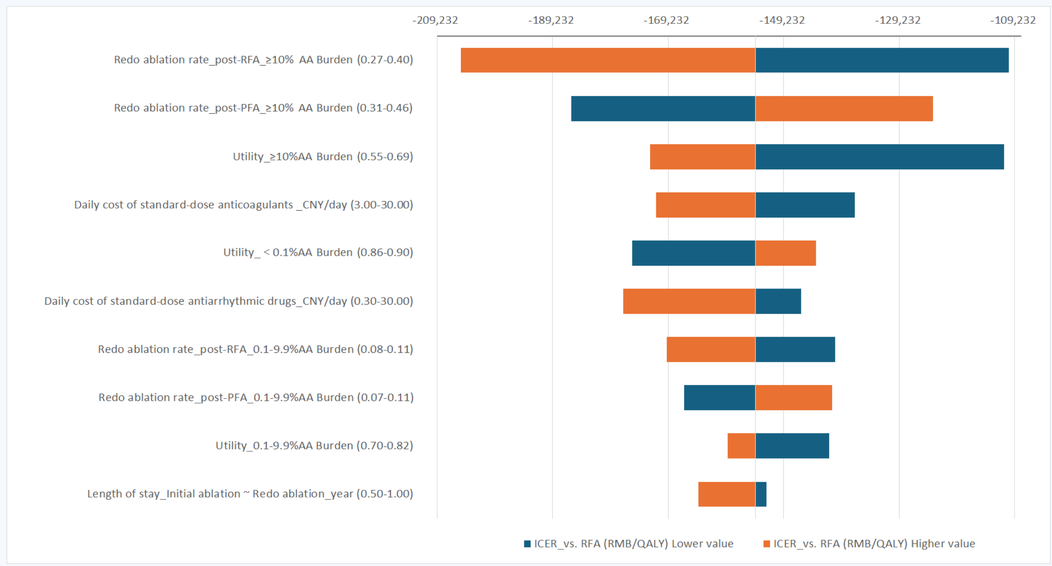
Pulsed field ablation saved ¥1,613 (¥69,702 vs. ¥71,316) and gained 0.0045 more QALYs (0.8607 vs. 0.8563) than cryoablation. This includes savings of ¥169 in post-operative complication management, ¥1,300 in repeat ablation surgery costs weighted by the number of procedures, and ¥133 in long-term medication costs for antiarrhythmic and anticoagulants. (Table 2)

Table 2 Results of base case cost-effectiveness analysis (PFA vs. Cryoablation)

	Ablation Methods		
	PFA	**Cryoablation**	**Incremental**
Total costs	**¥72,702.4**	**¥71,315.8**	**¥1,386.6**
Ablation procedure cost	¥68,000.0	¥65,000.0	¥3000.0
Weighted post-ablation complication-related costs	¥95.3	¥263.8	¥-168.5
Weighted redo ablation costs	¥1,769.3	¥3,069.7	¥-1,300.4
Weighted non-fatal stroke-related costs	¥55.2	¥67.1	¥-11.9
Weighted continued use of AADs and anticoagulants costs	¥2,782.6	¥2,915.2	¥-132.6
Total QALYs	**0.859**	**0.852**	**0.006**

One-way sensitivity analysis comparing PFA with RFA demonstrated that model results were most sensitive to the proportion of patients undergoing repeat ablation after initial RFA who had ≥10% AA burden. When compared to cryoablation, model results were sensitive to utility values across all three AA Burden states. (Figure 1)

A



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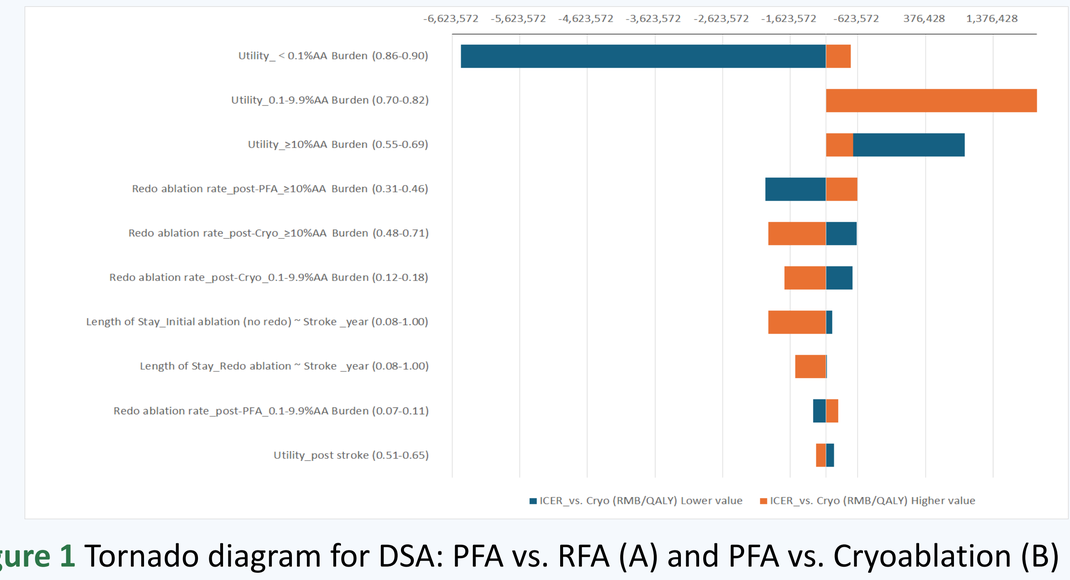
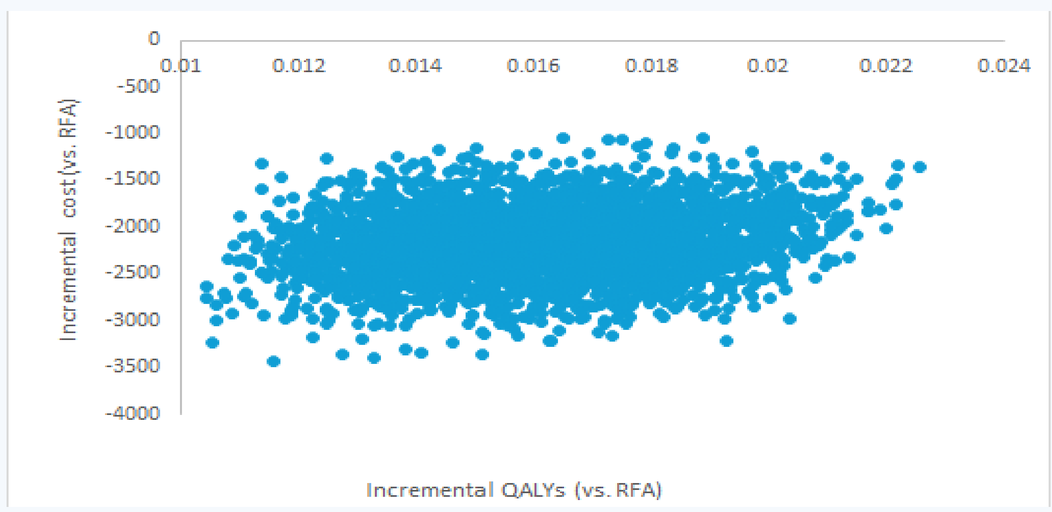


Figure 1 Tornado diagram for DSA: PFA vs. RFA (A) and PFA vs. Cryoablation (B)

PSA results showed most scatter points in the fourth quadrant, demonstrating PFA's absolute economic dominance over RFA and confirming model robustness. Due to the nearly equivalent QALYs between PFA and cryoablation, scatter points were evenly distributed along the Y-axis. But the concentration of all scatter points below the 1x per capita GDP threshold further suggests stable model results favoring PFA's cost-effectiveness over RFA. (Figure 2)

A



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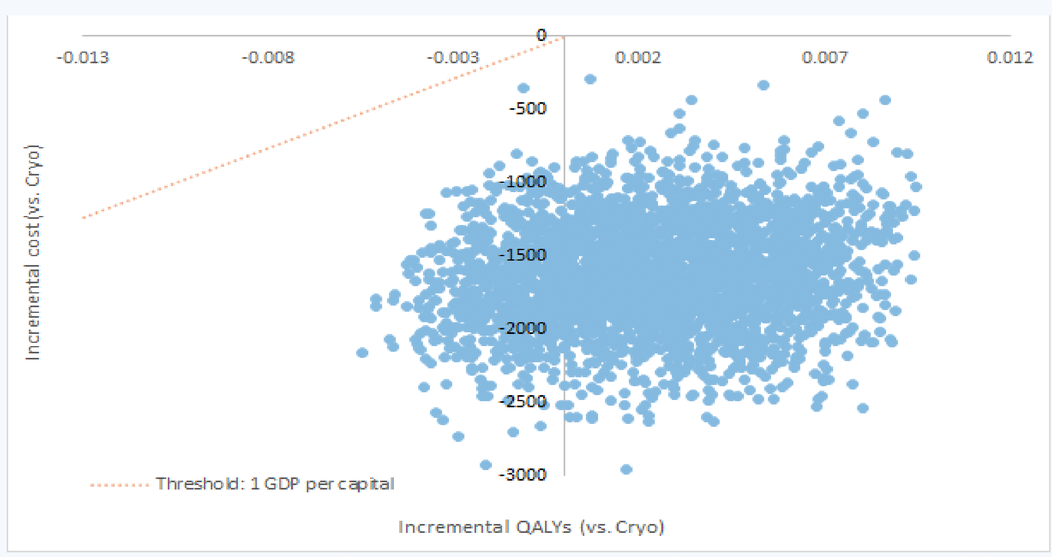

Figure 2 Incremental cost-effectiveness scatter plot for PSA: PFA vs. RFA (A) and PFA vs. Cryoablation (B)

CONCLUSIONS

Pulsed field ablation was likely to be more cost effective than both radiofrequency ablation and cryoablation in China.