SUMMARY

The Use of Intracardiac Echocardiography (ICE) Catheters in Endocardial Ablation of Cardiac Arrhythmia: Meta-Analysis of Efficiency, Effectiveness, and Safety Outcomes

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STUDY QUESTION

How does the use of ICE during catheter ablation of cardiac arrhythmias affect outcomes compared to ablation without the use of ICE?

METHODOLOGY

DESIGN: SYSTEMATIC LITERATURE REVIEW AND META-ANALYSIS

PubMed/MEDLINE was searched to identify studies between January 1, 1996 and October 31, 2018.

Data Sources: PubMed/MEDLINE

Study Eligibility: Comparative studies that assessed the use of intracardiac echocardiography (ICE) during the ablation of cardiac arrhythmia vs. ablation without ICE use

Analysis: A meta-analysis was performed to analyze and summarize outcomes from included studies

OUTCOMES

PRIMARY OUTCOME

- FLUOROSCOPY TIME

SECONDARY OUTCOME

- FLUOROSCOPY DOSE
- PROCEDURE TIME
- ACUTE PROCEDURE SUCCESS
- 6-MONTH FREEDOM FROM ARRHYTHMIA
- PERI-PROCEDURAL COMPLICATIONS

RESULTS

SYSTEMATIC LITERATURE REVIEW AND META-ANALYSIS

19 Studies included

2,186 Patients in included studies

PRIMARY OUTCOME

Use of ICE was associated with a significant decrease in fluoroscopy time

Use of ICE **reduced fluoroscopy time by an average of 6.95 minutes**

SECONDARY OUTCOME

Use of ICE was associated with a reduction in fluoroscopy dose and procedure time

Use of ICE **reduced procedure time by an average of 15.2 minutes**

CONCLUSION

This study finds that the use of ICE in the ablation of cardiac arrythmias is associated with **lower fluoroscopy time, reduced fluoroscopy dose and shorter procedure time.**

OBJECTIVE

How does the use of ICE during catheter ablation of cardiac arrhythmias affect outcomes compared to ablation without the use of ICE?

METHODS

Experimental Design

STUDY DESIGN	Systematic literature review and meta-analysis
IDENTIFICATION AND SCREENING	Studies that assessed the use of ICE during ablation of cardiac arrhythmia vs. ablation without ICE were identified using PubMed/MEDLINE in English between January 1, 1996 and October 31, 2018.
ANALYSIS	• Intention-to-treat results were extracted and compared using a risk ratio (RR) • Continuous and time outcomes were compared using standardized mean difference (with Hedges' g adjustment) • Sensitivity analysis was used to compare ICE vs. non-ICE in AF only populations • Acute procedure success and safety outcomes were estimated using a random-effects Mantel-Haenszel (MH) risk ratio

INCLUSION CRITERIA	EXCLUSION CRITERIA
• English-language • Comparative (randomized or non-randomized) • >10 patients undergoing endocardial ablation for any form of cardiac arrhythmia • Ultrasound imaging using sensor-based SOUNDSTAR® Catheter or non-sensor based catheters (ACUSON AcuNav™, ULTRA ICE™, ViewFlex™)	• Did not include a procedure of interest • Did not use real-time guidance during the ablation procedure • Did not report any outcomes of interest

STUDY OUTCOMES

PRIMARY OUTCOME

FLUOROSCOPY TIME

SECONDARY OUTCOME

FLUOROSCOPY DOSE

PROCEDURE TIME

ACUTE PROCEDURE SUCCESS

6-MONTH FREEDOM FROM ARRHYTHMIA

PERI-PROCEDURAL COMPLICATIONS

STUDY CHARACTERISTICS

The initial search retrieved 1,349 studies. After screening, 19 studies were included in the meta-analysis, studying 2,186 patients. 11 out of 19 studies were RCTs and 13 studies included a strictly AF population.

STUDY OUTCOMES

Primary Outcome

FLUOROSCOPY TIME

Use of ICE was associated with a **statistically significant average 6.95 minute decrease in fluoroscopy time** (MD -6.95; 95% CI -11.25 to -2.66; p < 0.01). A greater reduction (12.74 minutes) was seen with use of sensor-based ICE catheters such as the SOUNDSTAR® catheter (p = 0.02).

Secondary Outcome

FLUOROSCOPY DOSE

Use of ICE was associated with a **statistically significant decrease in fluoroscopy dose.** (Hedges g' -1.27; 95% CI -1.91 to -0.62).

PROCEDURE TIME

Use of ICE was associated with a **statistically significant average 15.2 minute decrease in procedure time** (Hedges g' -0.35; 95% CI -0.64 to -0.05).

Use of ICE for ablation of cardiac arrhythmias was associated with reduced fluoroscopy time, fluoroscopy dose and procedure time.

ACUTE PROCEDURE SUCCESS

6-MONTH FREEDOM FROM ARRHYTHMIA

PERI-PROCEDURAL COMPLICATIONS

No significant differences were observed in outcomes of acute success, freedom from arrhythmia and peri-procedural complications between ICE-guided and non ICE-guided cardiac ablations.

Sensitivity analyses limiting studies to an AF only population confirmed that significant differences in fluoroscopy time, fluoroscopy dose and procedure time were also observed in AF specific populations.

OUTCOME	ESTIMATE	95% CI	NO. OF STUDIES	*P*-VALUE
Fluoroscopy time	-8.12 minutes	(-13.45; -2.79)	11	< 0.01
Fluoroscopy dose	-1.32	(-2.04; -0.59)	9	< 0.01
Procedure time	-17.96 minutes	(-30.22; -5.71)	12	< 0.01

STUDY LIMITATIONS

Study limitations include:

- Only English-language published evidence indexed within PubMed/MEDLINE or manual reference checks was reviewed
- Broad comparator groups and time periods did not account for advancements in technology
- Heterogeneity observed in analyses examining efficiency outcomes
- Some RCT studies were downgraded from level 2 to 3 due to confounding/quality issues.

However, there was no evidence of publication bias or small-study effects, and the treatment effects were robust in sensitivity analysis.

CONCLUSION

This study compared clinical outcomes between the ablation of cardiac arrhythmias with the absence or presence of ICE use. When compared against catheter ablations without ICE, use of ICE was associated with **lower fluoroscopy time, fluoroscopy dose, and a reduction in procedure time**, without compromising safety or clinical effectiveness.