What's in YOUR denominator?

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In this issue of the *Journal*, Ad and colleagues¹ describe their single-center experience with pacemaker implantation (PMI) following the surgical Cox-Maze procedure. The authors state that the study was prompted by the rate of PMI recently reported in the Cardiothoracic Surgical Trials Network (CTSN) trial,² with a desire to study the “potential implication on the decision-making associated with surgical ablation of atrial fibrillation (AF).” They postulate that surgical technique is a major factor in the differing rates of PMI, identifying surgeon training and experience as an opportunity for improvement. However, a look at the data—theirs as well as others—suggests that there is more to the story.

In their multivariable analysis, a concomitant operation involving 2 or more valves was the only significant risk factor. Accordingly, a comparison of the rates of PMI across trials should take into account the heterogeneity of the study populations. A notably greater proportion of patients in both the CTSN and Atricure Bipolar Radiofrequency Ablation of Permanent Atrial Fibrillation (ABLATE) trials underwent a multiple valve operation (Table 1). In addition, a full 21% of the patients in the study by Ad and colleagues¹ underwent isolated AF surgery, compared with all-concomitant operations in CTSN and ABLATE. Although length of stay is discussed in the paper as a tool to navigate the issue of PMI timing, the impact of heterogeneous patient characteristics and operations on length of stay across studies is a

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Central Message

The population of patients undergoing surgical treatment of atrial fibrillation is heterogeneous. Adequately powered studies are needed to determine which risk factors are significant.

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confounding factor. Further muddying the comparison, a number of additional factors have been reported inconsistently across studies, including the incidence of preoperative pacemaker, perioperative antiarrhythmic drug usage, and surgical technique such as the management of the cavo-tricuspid isthmus line. The use of perioperative antiarrhythmic drugs is of particular relevance to the return of sinoatrial node dysfunction, which is the predominant indication for PPM after Cox-Maze procedures.³

Ad and colleagues are not the first to examine the rate of PMI after surgical ablation, and previous papers not referenced in their manuscript are worth briefly mentioning for further context. A much earlier experience found a trend towards increasing age in patients with early PMI.⁴ The authors of a more recent multivariate analysis found age

TABLE 1. Selective comparison of characteristics from recent surgical ablation studies

	Ad and colleagues ¹	CTSN, ² ablation*	CTSN, ² biatrial arm	ABLATE ³
Age, y, mean ± SD	63.4 ± 11.1	69.7 ± 10.4	68.2 ± 10.4	70.5 ± 9.3
Concomitant cardiac operation, %	79	100	100	100
Multiple valve operation, %	16.9	48.1	45.5	25.5
Nonparoxysmal AF, %	NR	100	100	92.7
PMI, %	7.0	19.5	24	22.9
PMI Indication				
SND, %	67	35	NR	64
AVND, %	23	54		36
Intact conduction at late follow-up	23% (12/52)	NR	NR	54.5% (6/11)

CTSN, Cardiothoracic Surgical Trials Network; ABLATE, Atricure Bipolar Radiofrequency Ablation of Permanent Atrial Fibrillation; SD, standard deviation; AF, atrial fibrillation; NR, not reported; PMI, pacemaker implantation; SND, sinus node dysfunction; AVND, atrioventricular node dysfunction. *Includes the cohort randomized to PVI or biatrial maze.

to be the only significant variable associated with both early and late PMI. Early rates of PMI were greater in those patient undergoing concomitant operations.⁵ The authors noted that those undergoing concomitant operations were on average a decade older than patients with lone Cox-Maze. Similarly, more than half of the patients in the CTSN trial undergoing ablation were >70 years old. Whether age and multiple valve operations merely covary or are independent risk factors for PMI will require studies that are powered to answer this question. Ad and colleagues do not report the age range of their population, but it was notably younger than other studies, including by nearly a decade compared with ABLATE. With a similar standard deviation value, this raises the possibility of a truly significant different population.

Thus, a number of issues brought forth by this study raise the bar for examination of PMI rates after surgical ablation. We find it concerning, however, that the authors reference only one other study for PMI rate comparison and so strongly emphasize the role of surgical technique without clear context to support their assertion, especially given the disparate results with other expert AF centers such as Northwestern⁶ and Washington University.⁵ Given the disparity between the patient characteristics of their study

and others, and considering the relationship between AF and valvular disease, 2 other possibilities exist: either patients undergoing AF surgery at their center are a different population than at other centers, or the management of valvular disease at this center is less aggressive than at other centers. Without a more homogeneous comparison, the deduction that surgeon training and experience should be the targeted area of opportunity is premature.

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