



## Association Between BMI and QoL Improvement in AF Patients Following Catheter Ablation

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### Introduction

As quite a lot of data has been recently reported on the impact of body mass index (BMI) on (1.) the risk of atrial fibrillation (AF) development, (2.) peri-procedural risk in pulmonary vein isolation (PVI) and (3.) PVI outcome, as well as (4.) quality of life (QoL) after PVI, we would like to dedicate our review to these topics. We will try to give a general picture about the impact of obesity on AF and end our review commenting on new data specifically highlighting the association between BMI and QoL improvement in AF patients following catheter ablation.

### BMI and AF Risk

Obesity has been shown to not only be associated with various cardiovascular risk factors as arterial hypertension, diabetes, hyperlipidemia, or coronary artery disease, but also to be directly linked with AF risk. Tedrow et al. reported a linear association between BMI and AF risk, with a 4.7% increase in risk with each kg/m<sup>2</sup> in the Women's Health Study.<sup>1</sup> In multivariable models, 1.65-1.77-fold elevations in AF risk were reported among the obese (BMI > 30 kg/m<sup>2</sup>). Adjustment for inflammatory markers (ICAM-1, hsCRP, and fibrinogen), which could potentially be mediators of obesity-associated risk, only minimally attenuated the prevalence of AF. The adjusted proportion of in-

cident AF correlating to short term elevations of body weight also was rather substantial (18.3%), showing a significant short term impact on the increase of AF. The authors concluded that in this population of apparently healthy women, BMI was associated with short and long term elevations in AF risk. These findings are consistent with data shown by a recent trial including 6,903 Swedish men<sup>2</sup> as well as with data reported from the Framingham population with an overall 50% increase in the risk of AF development with obesity.<sup>3</sup> The propensity of the obese population to develop AF is attributable to left ventricular diastolic dysfunction and left atrial (LA) dilatation.

These findings may give us a clue about the answer why the prevalence of AF over the last decades has been rapidly increasing, which cannot be entirely explained by the aging of the population.<sup>4</sup> Therefore a strategy of weight control may not only influence traditional risk factors linked to obesity but also reduce the increasing incidence of AF. The potential of such a "global weight lowering attempt" is much more likely and reasonable to produce a greater impact on public health than all our catheter ablation or antiarrhythmic drug strategies altogether. Nevertheless, we know that the prevalence of obesity (BMI > 30 kg/m<sup>2</sup>) and overweight (BMI > 25 kg/m<sup>2</sup>) is steadily increasing in western countries and no concepts have been able to slow down or stop this trend by now.<sup>5</sup>

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## BMI and Procedure-Related Risk in Catheter Ablation

Tang et al. reported a substantially increased incidence of left atrial (LA) or left atrial appendage (LAA) thrombi (10.6% versus 3.0%) in patients with BMI > 27 kg/m<sup>2</sup> admitted for catheter ablation of AF undergoing transesophageal echocardiography.<sup>6</sup> In this group of patients not anticoagulated previously (only 2.8% on warfarin at admission) multivariable analysis revealed BMI as an independent predictor of a LA/LAA thrombus in patients with AF showing an HR of 4.02 (95% CI 1.19-13.55, p=0.025). Additionally, a CHADS<sub>2</sub>-Score ≥ 2 and nonparoxysmal AF were the other two independent risk factors of LA/LAA thrombi.

Recognizing these data one should insist on proper anticoagulation prior to a catheter ablation attempt in overweight or obese to avoid any thromboembolic events during the electrophysiologic study.

A manuscript by Bohnen et al. analyzed predictors of major complications in catheter ablation treatment of cardiac arrhythmias.<sup>7</sup> Complication rates ranged between 0.8% in SVT, 5.2% in AF ablation, and 6.0% in VT ablation associated with structural heart disease. Whereas serum creatinine levels > 1.5 mg/dl increased the adjusted risk for major complications, BMI was not associated with higher risk.

Other studies specifically looking at AF ablation reported major clinical complications as follows: pericardial effusions, severe hypotension, AV-fistula, tamponade, stroke, hemidiaphragm paralysis, pulmonary vein stenosis, and groin hematoma with no difference between normal BMI vs. obese individuals and a total complication rate around 2% consistent with other studies on PVI.<sup>9-11</sup>

Therefore, one should not refuse PVI in obese patients keeping in mind potential problems of sedation with hypoxia or respiratory distress in patients with additional obstructive sleep apnea (OSA). This patient group should potentially be ablated under general anesthesia. Furthermore the amount of radiation exposure for obese patients will be nearly 3 times that of lean patients which has to be considered for the risk of radiation induced malignant tumors, especially in the setting of repeat procedures.

## BMI and Outcome of Catheter Ablation of AF

Obese or overweight individuals represent a substantial percentage of patients undergoing AF ablation in western countries. U.S. American studies report 18-28% of individuals with normal BMI, 39-44% overweight individuals, and 33-38% obese in consecutive patient populations scheduled for PVI showing a mean BMI of around 28-29 in the whole patient population.<sup>8,9,10</sup>

Various studies have been published on the influence of BMI on the outcome of catheter ablation itself. Most of these papers report 12-months follow-up data. The University of Michigan group reported no direct association between BMI and freedom from recurrent AF after PVI.<sup>11</sup> On the other hand overweight or obesity do strongly correlate with OSA, persistent AF, as well as elevated LA diameters. The latter three are well known risk factors for poor PVI outcomes with OSA being the strongest predictor in this study showing a hazard ratio of 3.04 (95% CI, 1.11-8.32, p=0.03).

Despite the association between obesity and AF, the BMI was not independently related to the risk of recurrent AF after PVI.<sup>9-11</sup> Therefore, it is possible that comorbid conditions such as elevated LA diameter and OSA are the key risk factors that promote recurrent AF in overweight or obese.

A recent manuscript from The Johns Hopkins Hospital could show obesity as an independent risk factor for PVI failure reporting a HR of 3.85 (95% CI, 1.04-14.27, p=0.04).<sup>8</sup> Furthermore, each unit increase in BMI was associated with an 11% increase in the probability of recurrent AF. OSA and LA size were associated with BMI but failed to predict ablation failure in this patient group.

Considering the data of this prospective study one should at least inform obese patients about the possibility of a worse outcome of PVI compared to normal BMI patients.

## Association Between BMI and QoL Improvement In AF Patients Following Catheter Ablation

QoL improvement has been the number one indication for AF ablation for more than a decade

by now.<sup>12</sup> QoL was mostly evaluated by a general health survey (Medical Outcomes Study 36-item Short-Form General Health Survey [SF-36]) in a number of different PVI studies.

Specifically looking at obesity in patients after PVI a prospective data collection of the Mayo Clinic revealed lower SF-36 scores for patients with higher BMI prior to PVI.<sup>9</sup> SF-36 scores improved in every functional domain for all BMI groups after ablation and BMI was not associated with increased risk of AF recurrence in this study population showing a weak trend towards reduced efficacy in the most obese population. The magnitude of QoL improvement was similar for all BMI groups leaving obese patients still with the lowest SF-36 scores despite the remarkable augmentation in QoL.

A patient consent should therefore clarify the anticipation of QoL improvement in obese clearly indicating that not all QoL reduction and symptoms are a result of AF (and therefore potentially cured by PVI) but to a certain extent also consequence of the elevated BMI itself.

The latest study giving a deep insight into the topic of BMI and QoL in AF patients undergoing catheter ablation was published by the group in Austin, Texas.<sup>10</sup> Using not only SF-36 scores but also the Beck Depression Inventory (BDI), Hospital Anxiety and Depression Score (HAD), and the State-Trait Anxiety Score they tried to give a broader picture of QoL impairment by AF in more than 700 consecutive patients. Interestingly at 12-month post-ablation assessment, no significant improvement of QoL was noted in the normal BMI group, whereas in the overweight / obese population QoL improved significantly in all scales, except the Physical Functioning and Bodily Pain categories of SF-36. The overweight / obese proportion of this population was 79%, which is rather high compared to other studies.<sup>6,12</sup> Furthermore the population was older ( $63 \pm 12$  years) and showed a high percentage of persistent AF (68%) which could explain different findings.

## Conclusions

1. BMI has been shown to be associated with short and long term elevations in AF risk which may give a reason for the rapidly increasing prevalence

of AF over the last decades. A strategy of weight control will be crucial to reduce the increasing incidence of AF in the future.

2. BMI is an independent predictor of a LA/LAA thrombus in patients with AF rendering anticoagulation treatment and pre-procedural TEE fundamental in obese patients.
3. Higher BMI is not associated with an increased rate of major peri-procedural complications.
4. Conflicting data exists about the impact of BMI on recurrent AF after catheter ablation therapy.
5. QoL improvement still is the number one indication for AF ablation and can be accomplished by catheter ablation of AF. Obese patients seem to benefit even more from PVI compared to normal BMI patients considering different QoL scores.

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