Novel technique for significant reduction of phrenic nerve injury in cryoballoon pulmonary vein isolation

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Background/Introduction: Pulmonary vein isolation (PVI) in cryoballoon (CB) technique is a golden standard for AF treatment. However, collateral damage of non-cardiac structures, such as phrenic nerve injury (PNI) remains an Achille’s heel of CB technology.

Purpose: The purpose of this study was to develop a therapeutic concept while establishing a new technique with three consecutive steps during the procedure in order to significantly decrease the occurrence of PNI in the intervention group in comparison with control group.

Methods: We conducted a retrospective, multicenter, observational review involving 1000 patients with symptomatic, treatment-resistant atrial fibrillation (AF) within last 8 years evaluating incidence and clinical characteristics of PNI during cryoballoon PVI. Patients were divided into the control (n=750) and intervention (n=250) groups. Patients in the intervention group were treated according to the new technique with three additional consecutive steps:

A-Phrenic nerve stimulation close to the stimulation threshold (double output) instead of 10V stimulation.
B-Advance approach for right superior pulmonary vein (PV) using the pre-freezing technique.
C-Pull away after vein isolation and/or after achieving -40°C for both right-sided PVs.

Results: A total of 1000 patients with a mean age of 63 (±11) years (62.3 % male) were investigated. 59.5% (n=595) of patients were admitted with paroxysmal AF, while 40.3% (n=403) suffered from persistent and 0.2% (n=2) from permanent AF. In 95.8% (958) it was the first PVI procedure. Two subtypes of PNI including permanent (without recovery until discharge) and transient (recovery until discharge) PNI were investigated. Transient PNI occurred in 8 patients (3.2%) in the intervention group compared to 46 patients (6.1%) in the control group, p=0.07. Persistent PNI occurred in one patient (0.4%) in the intervention group compared to 23 (3.1%) in the control group, p=0.017. Any PNI occurred in 9 patients in the intervention group (3.6%) compared to 69 patients (9.2%) in the control group, p=0.004.

Conclusion: This retrospective study provides insights into the use and effectiveness of our novel technique for PVI, which could markedly reduce the incidence of PNI, especially persistent PNI.