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# Phrenic nerve injury during pulmonary vein isolation using the second-generation cryoballoon: characteristics and follow-up - The YETI registry

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**Background:** Second-generation cryoballoon (CB2) based pulmonary vein isolation (PVI) has emerged as a safe and effective treatment option for symptomatic atrial fibrillation (AF). Although published complication rates of CB2 based-PVI are relatively low and several safety algorithms have been implemented in the protocols the most frequent complication is right-sided phrenic nerve injury (PNI). The reported incidence of PNI varies from 2–5% of patients. However data on PNI characteristics as well as follow-up is sparse.

**Purpose:** We aimed to evaluate the incidence, characteristics and outcome of PNI during after CB2 based-PVI in a large patients population.

**Methods and results:** From July 2012 to November 2018 a total of 13693 patients received CB2 or CB3 (third-generation) based-PVI in 23 EP centers (Germany: 12, China: 1, Turkey: 3, Japan: 3, USA: 1, Austria: 1, Poland: 1, Switzerland: 1). A total of 596 (4.4%) of patients experienced PNI during treatment of the right superior (84%) right inferior (15%) right middle (0.3%) (and left superior (0.3%) pulmonary veins. The mean time to PNI was 127±51 seconds and the mean temperature at the time of PNI was -49±7 °C. The target PV was isolated at time of PNI in 84% of cases.

The applications were interrupted using double-stop technique in (71%). In 212/306 (52%) a CMAP was utilized.

At the end of the procedure PNI persistent in 45% of patients. Fluoroscopic or sonographic evaluation of PNI was performed 1–3 days after the procedure and revealed persistent PNI in 35% of patients. Dyspnea before discharge was reported in 18% of patients with persistent PNI. Patients follow up at 1–3, and 6–12 months included fluoroscopy and a visit in an outpatient clinic. After 1–3 months 18% of patients showed persistent PNI including 13% of patients complaining of dyspnea. After 6–12 months of follow-up including fluoroscopic evaluation PNI was persistent in 1.8% of patients while dyspnea was reported by 1.7% patients. Only 0.08% of the overall population of 13693 patients showed permanent and symptomatic PNI.

**Conclusion:** The incidence of PNI during CB2-based PVI is low. About 55% of PNI recovered until the end of the procedure. Most of PNI recovered within 12 months. Symptomatic permanent PNI is very rare in patients after CB2/CB3-based PVI.