Background: Myocardial redox state is a key feature for atrial fibrillation (AF). We examined the mechanisms regulating myocardial superoxide (O2-) and peroxynitrite (ONOO-) generation in patients with chronic AF.

Methods: Samples of right atrium appendage were obtained from 113 patients undergoing elective cardiac surgery (98 in sinus rhythm (SR) and 15 with chronic AF). Myocardial O2- generation was determined by lucigenin chemiluminescence, while urate-inhibitable luminol chemiluminescence was used to estimate ONOO- generation. NADPH oxidase activity was estimated by the NADPH-stimulated O2- and its apocynin inhibitable fraction, uncoupled nitric oxide synthase (NOS) by using LNAME and mitochondrial oxidases by using rotenone.

Results: Patients with chronic AF had slightly but not significantly higher resting O2- (A). However, NADPH-stimulated (B) and apocynin-inhibitable (C) O2- were significantly greater in AF compared to SR patients. There was no significant difference in rotenone-inhibitable O2- (D). However, LNAME-inhibitable (E) and ONOO- generation (F) were significantly greater in AF compared to SR patients (F). Left atrium diameter was significantly correlated with NADPH-stimulated O2- (r=0.294, p=0.025) and apocynin-inhibitable O2- (r=0.288, p=0.032).

Conclusions: Chronic AF is characterized by greater NADPH-oxidase activity, NOS uncoupling and elevated ONOO- generation in atrial myocardium. Targeting these mechanisms provides new therapeutic strategies for AF.