Pericardium-Myocardium Interaction in Lipopolysaccharide-induced Left atrium arrhythmogenesis

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Introduction: Atrial fibrillation (AF) is the commonest sustained arrhythmia, and the pathogenesis of AF is multifactorial. Pericarditis may be associated with occurrence and recurrence of post-operation AF. Toll-like receptor 4 (TLR4) expression significantly increases in atrial fibrillation. TLR4 binds to lipopolysaccharide (LPS) to induce pro-inflammatory cytokines. Therefore, the purpose of this study will evaluate the role of TLR in LPS-induced left atrial (LA) arrhythmogenesis.

Methods: We use LPS (1-2mg/kg) injected into pericardium of the New Zealand rabbits to induce pericarditis. Conventional microelectrodes were used to record the action potentials (APs) and spontaneous activity of LA posterior wall (LAPW) and LA appendage (LAA) covered with pericardium with or without treatment of LPS or TLR4 inhibitor (TAK-242, 100 ng/mL).

Result: 1. LPS can increase spontaneous activity rate in LAPW (p<0.05) (Fig.1 A), but not in LAA. Rapid atrial pacing did not induce sustained spontaneous activity in control LAPW, but induced burst firing in LPS-treated LAPW (Fig.1 B). Rapid atrial pacing did not induce sustained spontaneous activity in control LAA, but induced burst firing in LPS treated LAA (Fig.1 C). 2. All LPS-treated LAPW with burst firing, the rate increased after covering with LPS-treated pericardium (Fig.2 A), but subsided after covering with control pericardium (Fig.2 B). 3. Under rapid atrial pacing, sustained spontaneous activity was found in 9 of 9 control LAPW covered with LPS-treated pericardium (Fig.2 C), and 5 of 9 control LAPW covered with control pericardium (Fig.2 D). 4. Among LPS-treated LAA with burst firing, the rate increased after covering with LPS-treated pericardium (Fig.3 A), but subsided after covering with control pericardium (Fig. 3 B). 5. Control LAA did not show spontaneous activity under rapid atrial pacing, and control pericardium did not induce triggered activity (Fig.3 C) but LPS-treated pericardium induced sustained spontaneous activity in control LAA (Fig.3 D). 6. Moreover, all burst firing induced by LPS-treated pericardium can be subsided by TAK-242 in LAPW with or without LPS treatment (Fig.4), and in LAA with or without LPS treatment (Fig.5).

Conclusion: LPS-induced pericarditis model can show that pericarditis may modulate electrophysiological characteristics of LAPW and LAA, and increase arrhythmogenesis. TLR4 inhibition can inhibit the occurrence of arrhythmia that can be used as a reference for AF treatment in the future.