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IMBALANCE BETWEEN TISSUE INHIBITOR OF METALLOPROTEINASE-1 AND MATRIX METALLOPROTEINASE-9 AFTER CARDIOPULMONARY RESUSCITATION

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Aims Cardiac dysfunction after CPR has been proved to be one of the most important reasons for the death in the early period of successful cardiopulmonary resuscitation (CPR). Matrix metalloproteinases (MMPs) are a family of zinc-dependent endopeptidases, and they regulate the extracellular matrix turnover in a balance with tissue inhibitors of metalloproteinase (TIMPs). They are best known for their roles played in the chronic diseases such as ventricular remodelling of acute myocardial infarction, chronic heart failure, hypertension, occurrence or maintenance of atrial fibrillation and dilated cardiomyopathy. However, the imbalance between TIMPs and MMPs in acute pathological conditions could be also observed. This study aimed to determine whether (a) there was an imbalance between matrix metalloproteinase-9 (MMP-9) and tissue inhibitor of metalloproteinase-1 (TIMP-1) after CPR in a canine model of prolonged ventricular fibrillation (VF); (b) with the duration of VF, the degree of the imbalance would be greater; and (c) there was a relationship between the level of MMP-9 or TIMP-1 and the cardiac function.

Methods and Results VF was electrically induced in 24 dogs. The animals were randomly divided into three groups (sham control, n=8; 8 min VF, n=8; 12 min VF, n=8). Echocardiographic measurement and hemodynamic variables were recorded before VF and after return of spontaneous circulation. TIMP-1 and MMP-9 were analysed by Western blot and immunohistochemistry. Compared with sham controls, dogs under VF and CPR showed significantly decreased level of TIMP-1($p<0.001$), and with the duration of VF, the level of TIMP-1 declined ($p<0.01$). The level of MMP-9 did not achieve statistical significance in the three groups ($p>0.05$), however, they were higher in VF and longer-duration VF groups. The ratios of TIMP-1/MMP-9 were lower in VF groups ($p<0.05$). There was a negative correlation between TIMP-1 and left atrium dimension and left ventricular diastolic dimensions ($r=-0.83$, $r=0.9$, respectively, $p<0.01$), and a positive correlation between TIMP-1 and left ventricular ejection fraction ($r=0.85$, $p<0.01$)

Conclusions There was an imbalance between TIMP-1 and MMP-9 after CPR. The loss of TMP-1 and/or the increase in MMP-9 may contribute to the post-resuscitation cardiac dysfunction. Thus, for patients after CPR, drugs may be used to ameliorate prognosis by normalising the TIMP-1/MMP-9 balance.