ACUTE MYOCARDIAL INFARCTION -RELATIONSHIP BETWEEN KINETIC CELL DEATH AND MAGNESIUM AND POTASSIUM CONTENTS IN MYOCARDIUM AND SKELETAL MUSCLE-

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We have already reported a new theory on the pathogenesis of AMI, i.e. Kinetic cell death (KD) caused by over-contraction and over-extension of myofilaments. KD is induced by one shot of 50 mg caffeine into the right atrium after Ca setting, i.e. an intravenous injection of 5.5% calcium chloride at a constant rate for 5 hours. In order to identify the mechanism of KD induction, the amount of Mg and K in myocardium and skeletal muscle was measured into the following rabbit groups: Group 1-Control (6 rabbits): Group 2-Ca setting (16); Group 3-Ca setting + caffeine (12). In Group 1, amount of Mg in myocardium was $25.9 \pm 0.8 \mu\text{g}$ per 100 mg wet weight; in skeletal muscle $30.1 \pm 1.0 \mu\text{g}$. The amount of K in myocardium was $359.3 \pm 12.6 \mu\text{g}$ and in skeletal muscle, the value was $448.8 \pm 13.5 \mu\text{g}$. In Group 2 the amount of Mg in myocardium after Ca setting showed a significant decrease to $23.1 \pm 1.0 \mu\text{g}$ ($p < 0.005$), While K amount showed no significant change. In Group 3, Mg amount in myocardium showed almost the same decrease as in Group 2; furthermore, the Mg amount showed a significant decrease in cases where KD occupied more than 20% of the total area, in contrast to cases where KD occupied less than 5% of the total area. In the transverse specimens of the left ventricle. In the skeletal muscle, amounts of Mg and K did not decrease significantly in Group 2 and Group 3, in contrast to Group 1. This study shows in our KD model that the response in Mg and K shown in myocardium and in skeletal muscle is different. It has been clarified in particular that Mg amounts in the myocardial decrease before Kinetic cell death induction.

-48- METABOLIC GRADIENT OF ISCHEMIC INSULT IN THE LATERAL DIRECTION IN THE EPICARDIUM

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Metabolic insult of ischemic damage in the lateral direction in the myocardial ischemia is difficult to prove due to mixture of sampling between ischemic(IA) and non-ischemic area(NIA). The problem was solved by a new approach using 1) guillotine rapid-freezing device to obtain a short-axis frozen sample of 2.5 mm thickness from a beating heart in 120 msec, 2) NADH fluorescence photography to identify IA of frozen samples at -190°C , and 3) micro-sampling with a drill (2.5 mm in diameter, 0.8 mm in depth) at -190°C . IA of samples from 8 dogs with 20 min LAD ligation were clearly identified.

Mixture was avoided by enlarged photographs before and after sampling. Sampling sites were at the center (IA-C) and lateral margin (IA-M) of IA, and margin of NIA (NIA-M) along the epi- and endocardium. ATP and CP were following ($\mu\text{g}/\text{mg}-\text{prot.}$) :

n=8		NIA-M+	IA-M+	IA-C	IA-M++	NIA-M++
EPI	ATP	28+4	23+7	16+5**	21+4*	31+4
	CP	27+6	13+8*	10+6	15+8*	28+9
ENDO	ATP	32+4	16+6*	14+3	15+5*	30+3
	CP	30+5	9+7*	8+4	10+8*	23+4

($P < .01$ to **IA-M, *NIA-M, +:free wall, ++:IVS side)

Conclusion: 1)New approach eliminating mixture was made. 2)Sharp border exists between IA and NIA. 3)In IA, epicardial metabolic gradient in the lateral direction exists by ATP.

-49- CLOSE CORRELATIONS OF MYOCARDIAL OXYGEN DELIVERY AND METABOLIC CHANGES TO EARLY CONTRACTILE DETERIORATION

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Various degrees of myocardial oxygen(O_2) delivery reduction were induced in 23 open chest dogs by perfusing distal LAD with a blood substitute (Fluosol-DA: FDA), having different O_2 content and/or flow rate for 5 min. Blood pressure and heart rate did not change after 5 min of perfusion. A calculated oxygen delivery ratio($\text{O}_2\text{-DR}$) (flow ratio $\times \text{O}_2$ content of FDA / arterial blood) ranged from 1 to 238%.

The degree of $\text{O}_2\text{-DR}$ showed a linear correlation with %SS ($r=0.77$, $p<0.01$). The percent segment shortening became zero when $\text{O}_2\text{-DR}$ was 50%. An apparent dyskinesia developed after $\text{O}_2\text{-DR}$ reduced less than 50%. ATP did not change significantly ($4.3 \pm 0.5 \mu\text{mol/g}$ wet weight) until $\text{O}_2\text{-DR}$ reduced to 50%.

In contrast, the degree of $\text{O}_2\text{-DR}$ showed linear correlations with creatine phosphate content (CP: $r=0.72$, $p<0.01$) and subendocardial CP content($r=0.69$, $p<0.01$). Still more, there was a linear correlation ($r=0.67$, $p<0.01$) between %SS and subendocardial CP content.

In conclusion, the early regional contractile deterioration was induced by a minimal O_2 delivery reduction without ATP changes and was closely related to the degree of subendocardial CP reduction.

-50- METABOLIC CHANGES IN NON-ISCHEMIC MYOCARDIUM IN CARDIOGENIC SHOCK COM- PLICATED IN ACUTE MYOCARDIAL INFARCTION

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It may be possible that metabolic alterations in non-ischemic myocardium are partly related to development of cardiogenic shock complicated in acute myocardial infarction.

Acute myocardial ischemia was produced in dogs by ligating LAD for 2 hours, and they