

Maturation changes in respiratory control through creatine kinase in heart in vivo.

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The role of creatine kinase in regulation of myocardial respiration was studied in vivo as a function of maturation. Unidirectional creatine kinase flux (JCK), phosphocreatine to gamma-ATP, was measured in newborn lambs (age 3-9 days, n = 8) and mature sheep (age 30-60 days, n = 6) using ³¹P saturation transfer techniques, and total creatine kinase activity was measured using standard methods. Myocardial oxygen consumption (MVO₂) was measured simultaneously via an extracorporeal shunt from the coronary sinus as cardiac work was increased via epinephrine (1-3 micrograms.kg⁻¹.min⁻¹). Findings were as follows: 1) baseline newborn JCK was markedly lower than in mature sheep despite higher levels of MVO₂, and this could be related to a decrease in total creatine kinase activity; 2) JCK was substantially higher than the rate of ATP synthesis in both groups at baseline rates of oxygen consumption; and 3) JCK decreased significantly in newborns during increases in MVO₂, whereas there was no change in flux rate in the mature sheep during even larger relative changes in work and oxygen consumption. These data imply that creatine kinase does not limit oxidative phosphorylation. However, this enzyme system probably maintains at least an indirect role in respiratory control that is a function of the myocardial developmental state.