Adenosine release and high energy phosphates in intact dog hearts during norepinephrine infusion.

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Cardiac adenosine release is thought to depend on the oxygen supply/demand ratio, and this effect may be mediated by changes in high energy phosphate concentrations. Previous studies supporting this hypothesis have been done primarily in isolated hearts. We tested this hypothesis in intact dog hearts. Anesthetized, open-chest dogs were placed in a 4.7-T magnet where 31P nuclear magnetic resonance spectra were acquired via a surface coil over the heart at 2-minute intervals (60 scans, 2-second interpulse delay). Coronary sinus flow was shunted through a flow probe and returned via a jugular vein. After a control period, intracoronary norepinephrine was infused (12 micrograms/min) for 16 minutes and plasma samples were taken every 5 minutes. The phosphocreatine/ATP peak area ratio was used as an index of high energy phosphate changes. During norepinephrine infusion, arterial pressure, heart rate, coronary sinus flow, oxygen consumption, and adenosine release all increased significantly. Adenosine release peaked at 5 minutes but remained elevated after 15 minutes. There was a transient fall in the phosphocreatine/ATP ratio (9.2 +/- 3.1%, p less than 0.05) during the first 7 minutes, but the ratio returned to control levels by 9 minutes. The oxygen supply/consumption ratio increased after 5 minutes of norepinephrine infusion and then returned to control levels. We conclude that during norepinephrine infusion in vivo, persistent adenosine release can occur with only small transient changes in high energy phosphate concentrations and with no decrease in the oxygen supply/demand ratio.