Positive Chronotropic and Ruminolytic Actions of Adenosine in Goat

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ABSTRACT. Effects of intravenously infused adenosine on the ruminal electromyogram (EMG) and heart rate were investigated in conscious goats. Prompt inhibition of the ruminal EMG and tachycardia were observed by a low dose (0.2–0.5 mg/min) of adenosine. The responses were rapidly disappeared by quit of infusion. The positive chronotropic action seems to be species specific in goat.—KEY WORDS: adenosine, aminophylline, goat.


Despite the extensive investigations on the purinergic mechanism in the various species and organs [6], only a few reports on ruminants are available. This note describes the effects of adenosine on the rumen motility and heart rate in goats.

Three castrated male miniature goats (Shibayagi), weighing 25 through 30 kg, were used. A bipolar electrode (1.5 mm apart) made of silver wires (0.2 mm diameter) was punctured into the muscle layer at the appropriate site of the rumen dorsal sack and fixed with ligatures to the serosa. Postoperative animals were allowed to rest for at least 1 week. The muscular electrical activity was recorded on a polygraph (time constant 0.03 s). The heart rate was taken tachographically from E.C.G. Adenosine dissolved in saline was infused into the jugular vein through a indwelling catheter at a rate of 0.05, 0.2, 0.5 or 1.0 mg/kg/min for 10 or 20 min.

Under the resting condition, the ruminal EMG was recorded as a pair of spike bursts with interval of about 1 min. During the infusion of adenosine at a rate above 0.2 mg/kg/min, the bursts of EMG were shifted to a few minute spikes or completely abolished, and the heart rate increased to 120 to 200% of pretreatment rate. The responses were initiated promptly by the infusion and disappeared rapidly after quit of dosing. A typical result is presented in the figure.

Responses of the preparation to aminophylline, a known adenosine antagonist, seemed to be similar to the adenosine responses. In one goat, intravenous aminophylline (10 mg/kg or 1 mg/kg/min) caused a suppression of the ruminal EMG and tachycardia. On the other hand, only obscure responses were observed by the same dose in the other 2 goats, in which neither inhibition of ruminal EMG nor tachycardia by adenosine (0.2 mg/kg/min) was affected by coadministration of aminophylline (1 mg/kg/min), as shown in the figure.

The prompt responses to a low dose of adenosine shown in this experiment suggested a possible effect on the adenosine receptors in the rumen and heart.

Inhibitory action of adenosine on the gastrointestinal smooth muscle in various mammalian species including ruminants [5] was reported. The heart rate was, on the other hand, reported to reduce in guinea pig, rat, cat and dog [2, 4, 7]. In addition, adenosine has a negative inotropic effect in various species [1]. These effects of adenosine are known to be abolished by aminophylline.
Fig. 1. Effects of intravenous infusion of adenosine on ruminal EMG and heart rate in miniature goat. A pair of spike bursts is expressed as a vertical segment and a inhibited EMG as a dot. A part of typical EMG is traced on the top of figure.

Accordingly, positive chronotropic action of adenosine investigated in this study seems to be species specific in goat.

Jamal et al. reported the existence of 2 subtypes of adenosine receptor in the bovine coronary artery [3]. Since the opposite effects due to the subtypes are suggested, it is reasonable to consider that the dominant subtype is different between species. Further studies are necessary to elucidate the problem.

REFERENCES

要 約
山羊における第一胃 ENG および心拍数に対するアデノシンの作用: 福田正明・吐山豊秋 (東京農工大学外科学教室、薬理学教室) —アデノシンの小量（0.2~0.5 mg/kg/min）静脈内対照注入によって無麻酔シバ山羊第一胃 ENG は抑制され、心拍数は上昇した。反応は注入開始直後に発現し、注入停止によって速やかに消失した。この陽性変周期作用は山羊における種特異性反応であると考えられる。