Title: EFFECTS OF FENTANYL ON THE CAROTID CHEMOREFLEX

Authors: M. Zimpfer, M.D., A. Beck, M.D., G. Raberger, M.D., N. Mayer, K. Steinbereithner, M.D.

Affiliation: Clinic of Anesthesia and General Intensive Care and Pharmacological Institute, University of Vienna and Ludwig Boltzmann-Institute of Experimental Anesthesiology and Research in Intensive Care, 1090 Vienna, Austria.

Introduction:
Both barbiturates and volatile anesthetics dramatically alter the autonomic control of the cardiovascular system (1,2). However, it is widely held that narcotic analgesics do not depress the rapidly acting nervous control mechanisms for arterial pressure regulation. In order to examine this assumption quantitatively we studied the extent to which fentanyl affects responses to carotid chemoreceptor reflex activation (CCRA).

Methods:
9 mongrel dogs were chronically instrumented with electromagnetic flow probes and hydraulic cuff occluders on the right common iliac artery and with catheters in the abdominal aorta and in the left common carotid artery. Experiments were performed when the animals were apparently fully recovered from operation. CCRA was accomplished by injections of nicotine (4-8 µg) into the carotid catheter. The effects of fentanyl (4 µg/kg iv and 8 µg/kg iv) on responses to CCRA were examined on seperate experimental days in the animals with spontaneous ventilation and with ventilation held constant during infusion of succinylcholine. In order to eliminate any distress associated with intubation or the initiation of succinylcholine the upper airways were anesthetized and sodium thiamylal (4 mg/kg iv) was administered prior to intubation. Statistical significance was determined by analysis of variance.

Results:
CCRA in the conscious dogs with spontaneous ventilation elicited complex effects due to secondary stimulation of pulmonary inflation reflexes. CCRA in the conscious dogs with controlled ventilation caused bradycardia and elicited intense iliac vasoconstriction (Fig.1, Tab.1). Fentanyl significantly attenuated the increase in cardiac cycle length and in iliac resistance with CCRA.

Discussion:
Classic prior investigations indicate that the cardiovascular response to hypoxia and hypercarbia, which includes bradycardia and an increase in arterial pressure, is primarily reflex in origin. The most intense vasoconstriction occurs in the iliac bed. Both efferent arms of the autonomic nervous system, i.e. the parasympathetic and the sympathetic, manifested depressed responses to CCRA after fentanyl. We conclude that fentanyl interferes with the chemoreflex control of the circulation.

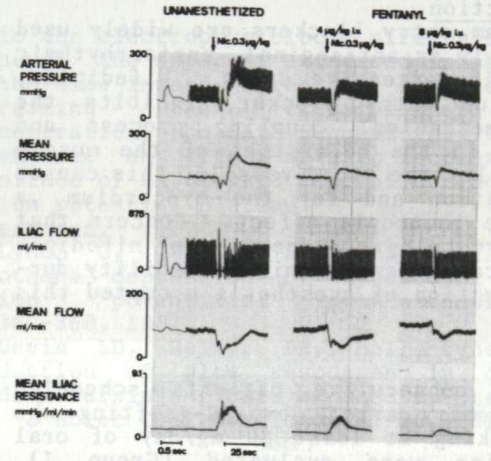

Fig.1. Responses to CCRA with nicotine in unanesthetized dog with controlled ventilation and after the addition of fentanyl.

	Unanesthetized	Fentanyl 4 µg/kg	Fentanyl 8 µg/kg
Cardiac cycle length (msec)	140 ± 18% (701 ± 22)	50 ± 7%* (756 ± 23)	19 ± 6% (887 ± 46)
Mean arterial pressure (mm Hg)	55 ± 8% (104 ± 2)	35 ± 5%* (106 ± 4)	25 ± 5% (112 ± 3)
Mean iliac flow (ml/min)	-55 ± 3% (115 ± 8)	-38 ± 4%* (100 ± 8)	-16 ± 3%* (79 ± 8)
Mean iliac resistance (mm Hg/ml/min)	252 ± 16% (0.91±0.07)	122 ± 9%* (1.10±0.08)	50 ± 5% (1.42±0.1

Tab.1. Effects of fentanyl on responses to CCRA. Means ± SEM. Control values are shown within parentheses. * Responses different from unanesthetized ($p<0.01$).

References:
1.) Cox RH, Bagshaw FJ: Influence of anesthesia on the response to carotid hypotension in dogs. Am. J. Physiol. 237: H424-H432 (1979).

2.) Zimpfer M, Sit SP, Vatner SF: Effects of anesthesia on the canine carotid chemoreceptor reflex. Circ. Res. 48: 400-406 (1981).