

Title: DIFFERENT RESPONSE OF BOLUS OR CONTINUOUS INFUSION OF SUFENTANIL ON BRAIN MICROCIRCULATION

Authors: G.P. Lu, M.D., J. Prinscott, M.D., E.A.M. Frost, M.D., J.A. Gibson, B.S. and P.L. Goldiner, M.D.

Affiliation: Department of Anesthesiology, Albert Einstein College of Medicine/Montefiore Medical Center, Bronx, NY 10461

**Introduction.** Sufentanil, a potent short-acting narcotic, has been shown to decrease cerebral blood flow (CBF) (1,2). However, little is known concerning its effect on brain microcirculation and hemodynamic response.

This study is designed to determine the effect of sufentanil intravenously by simultaneously monitoring diameter (ID) and red cell velocity (Vrbc) changes in single pial microvessels and changes in calculated volumetric flow (Q), intracranial pressure (ICP) and cerebral perfusion pressure (CPP).

**Method.** Rats, 200-250 g (n10) were anesthetized with pentobarbital (30 mg/kg). Femoral arterial BP was recorded and blood gases and pH were maintained by controlled ventilation via a tracheostomy. Femoral vein was cannulated for infusion of sufentanil. A left parietal craniotomy with an encapsulated cranial window was prepared for biomicroscopy. Changes in the internal diameter of three orders of arterioles (15-50  $\mu$ m were measured by image-shearing. In selected arterioles (n15) Vrbc (mm/sec) was measured by the dual-slit photometric method and correlation technique and Q ( $\times 10^{-3}$  mm<sup>3</sup>/sec) calculated (Vrbc  $\times \pi D^2/4$ ) (3). ICP was measured through an outlet port of the cranial window. Percent change of CPP was calculated based on the difference between mean BP and ICP.

**Results.** Sufentanil 1-5  $\mu$ g/kg IV bolus resulted in significant decrease in BP (39% P<0.001), arterial ID (14% P<0.02), Q (25% P<0.02) and CPP (46% P<0.001). However, venule ID and ICP changes were insignificant. The infusion of sufentanil (0.015  $\mu$ g/kg/min) resulted in small changes in ID and Q without significant decrease in BP, ICP and CPP (Figure 1) (Table 1).

**Discussion.** The effect of sufentanil infusion in the rat resulted in dose-related hypotension, pial arteriolar constriction and decrease in Q. These results demonstrate that a vasoconstrictive effect of sufentanil is accompanied by a decrease in regional CBF during hypotension initiated by sufentanil. However, hemodynamic stability is maintained during infusion of small doses of sufentanil. Our findings underscore the need for carefully monitoring hemodynamic parameters in clinical settings during bolus infusion of sufentanil especially in patients with critical blood brain perfusion.

This study was supported in part by a grant from Janssen Pharmaceuticals and Departmental Funds.

**References.**

1. Keykhah MM, Smith DS, et al: Influence of sufentanil on cerebral metabolism and circulation in the rat. *Anesthesiology* 63:274-277, 1985
2. Keykhah MM, Smith DS, et al: Effects of sufentanil on cerebral blood flow and oxygen consumption. *Anesthesiology* 57:A248, 1982

3. Lipowsky HH, Zweifach BW: Application of "two-slit" photometric technique to the measurement of microvascular volumetric flow rates. *Microvasc Res* 15:93-101, 1978

Figure 1. Typical experiment shows that, at the dose used, sufentanil bolus but not infusion, resulted in hypotension and decrease in diameter and volume flow in pial arterioles.

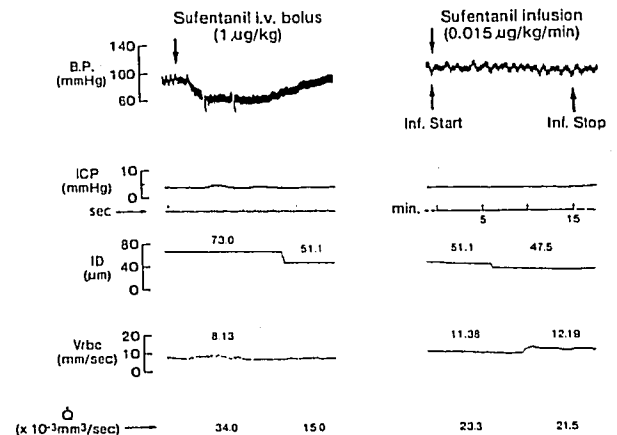


Table 1. Changes expressed as % of control in all data.

	Sufentanil IV Bolus 1-5 $\mu$ g/kg	Sufentanil Infusion 0.015 $\mu$ g/kg/min
BP	61.3 $\pm$ 5.5**	98.2 $\pm$ 2.7
Art. ID	86.3 $\pm$ 2.5*	93.8 $\pm$ 3.1
Ven. ID	98.8 $\pm$ 2.1	99.5 $\pm$ 1.3
Vrbc	81.8 $\pm$ 3.4*	99.2 $\pm$ 7.7
Q	74.9 $\pm$ 7.2*	89.7 $\pm$ 13.7
ICP	107.1 $\pm$ 12.3	101.7 $\pm$ 1.2
CPP	54.0 $\pm$ 6.2**	99.8 $\pm$ 1.2

Remarks: Data presented as mean  $\pm$  S.E.  
\* P<0.02      \*\* P<0.001