Title: SUFENTANIL-OXYGEN COMPARED WITH FENTANYL-OXYGEN ANESTHESIA FOR CORONARY ARTERY SURGERY

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Introduction: Sufentanil, a synthetic narcotic, has been reported to be five to ten times more potent than fentanyl. The increased potency of sufentanil suggests (1) that the suppression of autonomic response will be more complete and predictable than is the case with fentanyl, and (2) that the improved control of response will ensure a higher proportion of stable surgical cases when compared to fentanyl. The primary objective of this study was to evaluate the catecholamine and hemodynamic response at certain periods of stimulation during coronary artery surgery for both fentanyl and sufentanil and to compare the two agents. A secondary objective was to assess the time to loss of consciousness and the stability of blood pressure during cardiopulmonary bypass with sufentanil and fentanyl.

Methods: Institutional approval was obtained for this prospective randomized trial. Each patient (n=48) gave written informed consent and was randomly assigned to Group I (fentanyl, 100 ug/kg) or Group II (sufentanil, 20 ug/kg) after the preoperative visit.

The 26 sufentanil and 22 fentanyl patients were all NYHA Class III subjects between 38 and 72 years of age. The fentanyl and sufentanil groups were closely matched in age (58 ± 8 and 56 ± 9 years), body surface area (1.9 ± 0.2 and 2.0 ± 0.2 m^2), ejection fraction (0.5 ± 0.1 and 0.5 ± 0.2), and LVEDP (16 ± 8 and 14 ± 8 torr). All required saphenous bypass grafts for coronary artery disease; 64% required 3 or 4 vein grafts.

Patients were premedicated with lorazepam (0.5 mg/10kg PO) and continued on their usual dose of propranolol. They were monitored during surgery via radial artery and Swan-Ganz catheters placed prior to induction. Patients breathed 100% oxygen via mask prior to induction and a baseline profile of 10 measured and 15 derived parameters was taken. The duration of the induction narcotic infusion was recorded along with the time to loss of consciousness, measured by lack of response to verbal commands.

Patients were induced with either 50 ug/kg of fentanyl or 10 ug/kg of sufentanil with pancuronium 0.1 mg/kg given concurrently. Ventilation by mask was continued until intubation, after which 100% oxygen ventilation was continued at 10 ml/kg.

Five minutes before sternotomy patients were given an additional dose (25 ug/kg fentanyl or 5 ug/kg sufentanil) of agent. This same dosage was administered at the beginning of cardiopulmonary bypass together with 2 mg of lorazepam. Additional pancuronium was given on bypass to a total of 0.2 mg/kg.

Hemodynamic measurements were made one, two, and five minutes after each of the following events: induction, skin incision, sternotomy, pre-bypass, post-bypass, chest closing, and at entry, two hours and four hours in the surgical intensive care unit. Blood samples for radioenzymatic plasma catecholamine assays were drawn prior to induction and five minutes after induction, sternotomy, during the pump run, after protamine administration, chest closing and four hours in the SICU.

Results: Induction with sufentanil produced a 7% decrease in mean arterial blood pressure (MAP) compared with a 4% decrease in MAP for the fentanyl group. The difference between the groups was not statistically significant. Systemic vascular resistance (SVR) also fell 20% in the sufentanil group (from 1370 to 1090 dyne-cm^{-5}) while in the fentanyl group it fell only 4% (from 1350 to 1300). Heart rate did not change significantly in either group, but cardiac index increased in the sufentanil group by 20% (from 2.5 to 3.1 $l\text{-}min^{-1}\text{-}m^{-2}$). The fentanyl group's cardiac index did not change. No clinically meaningful change in other hemodynamic parameters was observed at induction.

There were no statistically significant differences between the groups' hemodynamic response to sternotomy, although 12% of the patients in the sufentanil group had systolic pressures above 150 torr two minutes after sternotomy. No significant difference between groups was found for catecholamine levels at sternotomy. These results are summarized in the following table:

STERNOTOMY	Fentanyl	Sufentanil	
M. A. P.	95 ± 15	92 ± 11	torr
Systolic Pressure	142 ± 17	139 ± 18	torr
Heart rate	69 ± 14	72 ± 12	b.p.m.
S. V. R.	1561 ± 421	1462 ± 390	dyne-cm^{-5}
Epinephrine	298 ± 139	341 ± 192	pico-g/ml
Dopamine	145 ± 76	163 ± 86	pico-g/ml
Norepinephrine	67 ± 26	91 ± 75	pico-g/ml

At every period of measurement the sufentanil group's SVR was slightly lower than the fentanyl groups, but this difference was never statistically significant by the unpaired Student's t-test. The distribution of hypertension (systolic pressure greater than 150 torr) was similar for each group. Overall, 15% of the 859 measurements of systolic pressure were above 150 torr. There was no significant difference in mean pressures of the groups during cardiopulmonary bypass. The maximum pressures during bypass were 89 ± 16 torr in the fentanyl group and 85 ± 15 torr in the sufentanil group.

Discussion. This study suggests that sufentanil is a potent agent for cardiac surgery, and that its stability compares well with that of fentanyl. Sufentanil appears to be five times more potent than fentanyl for the coronary artery surgery patient. Doses of 20 ug/kg produce adequate anesthesia for this type of surgery. At this dosage level sufentanil does not appear to suppress autonomic response any better than fentanyl, although it may do so at higher dosage levels.