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Title: HEMODYNAMIC EFFECTS OF BUTORPHANOL-OXYGEN IN ANESTHESIA IN DOGS

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Introduction: Large doses of morphine (2-3 mg/kg) or fentanyl (50-100 mg/kg) produce complete anesthesia in dogs and man during oxygen breathing. Although anesthetic doses of fentanyl result in less detrimental side effects than comparable doses of morphine both techniques cause post-operative respiratory depression. An analgesic compound that is capable of producing complete anesthesia, results in little or no alteration in circulatory dynamics and produces less side effects than fentanyl or morphine would be an improvement as an anesthetic agent. Butorphanol tartrate, a synthetic morphomimetic compound which has analgesic agonist and antagonist properties, has been reported to provide adequate anesthesia as a supplement to balanced anesthetic techniques when compared to morphine and meperidine.[1] The cardiovascular effects of high (anesthetic) doses of butorphanol during oxygen breathing are unknown. This study was designed to investigate the cardiovascular effects of intravenous butorphanol tartrate in the dog during inhalation of oxygen and oxygen and nitrous oxide.

Methods: Sixteen mongrel dogs (17-28) kg served as the experimental subjects. Each had an 18 gauge intravenous infusion started in a foreleg vein, was induced with sodium thiopental (20-25 mg/kg) and had its trachea intubated. Respiration was controlled with 100% oxygen at a rate and tidal volume to keep $PaCO_2$ between 30-35 torr. A quadruple lumen balloon tipped pulmonary artery catheter with thermistor was placed in the pulmonary artery via a right internal jugular vein cutdown for determination of thermodilution cardiac output (Q_T) and measurement of right atrial ($\overline{RAP}$), mean pulmonary artery ($\overline{PAP}$) and mean pulmonary capillary wedge pressure ($\overline{PCWP}$). A second catheter was inserted into the aorta through a femoral artery for sampling arterial blood and measuring mean systemic arterial pressure ($\overline{AP}$). Pulmonary ($\overline{PVR}$) and systemic vascular resistances ($\overline{SVR}$) were calculated from the data obtained. The dogs were divided into four groups; group A received Butorphanol (0.1 mg/kg/min, IV)group B Butorphanol (0.1 mg/kg/min, IV plus atropine 2 mg IM), group C Butorphanol (0.2 mg/kg/min, IV), group D Butorphanol (0.2 mg/kg/min, IV plus atropine 2 mg, IM). Atropine was administered thirty minutes prior to collection of control data. Butorphanol was administered at the above doses for 30 minutes. Hemodynamic measurements were obtained at 5 minute intervals during Butrophanol infusion and at the end of the infusion. The animals were then ventilated with N_2/O_2 (60%-40%) for 15 minutes at which time hemodynamic measurements were repeated. The animals were then ventilated with N_2O_2 (60%-40%) for 15 minutes following which hemodynamic measurements were repeated again.

Results: All groups sustained significant and similar decreases in heart rate, Q_T and $\overline{AP}$ and an increase in $\overline{RAP}$ at each measurement period during ventilation with O_2. Q_T was further decreased (similarly in all groups) with ventilation with N_2O-O_2 but not with N_2-O_2.

$\overline{PCWP}$, PVR and SVR were not significantly changed by butorphanol during oxygen breathing but $\overline{PCWP}$ and SVR were increased with the addition of N_2O to the inspired gases.

Discussion and Conclusion: The results of this study demonstrate that large doses of butorphanol tartrate produce myocardial depression during oxygen breathing in the dog and, unlike morphine or fentanyl anesthesia, atropine premedication does not prevent these changes.[2] The data also show that, as with most morphomimetic compounds, addition of N_2O during butorphanol infusion produces marked cardiovascular depression.[2,3] Our findings indicate that the cardiovascular depression found during butorphanol-oxygen anesthesia is similar to that found with meperidine-oxygen anesthesia in the dog and much greater than that which occurs with fentanyl or morphine-oxygen anesthesia.[2,3] These results suggest that large doses of butorphanol plus oxygen produce too much myocardial depression to be considered as an alternative to morphine or fentanyl-oxygen anesthesia in patients with severe cardiovascular disease.

References:

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