
CARDIOPULMONARY EFFECTS OF ETORPHINE IN IMMOBILIZED WHITE RHINOCEROS (*Ceratotherium simum*) AND SUBSEQUENT INTRAVENOUS ADMINISTRATION OF BUTORPHANOL

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Abstract

Chemical capture is an essential tool in the management of free-ranging white rhinoceros. Etorphine results in rapid central nervous system depression following intramuscular administration in rhinoceros.² Etorphine is combined with azaperone to reduce induction times, and this combination is associated with hypoxemia and hypercapnia in white rhinoceros.⁴ Butorphanol, a mixed opioid agonist - antagonist, is frequently administered intravenously in immobilized rhinoceros to mitigate these adverse effects; however, variable and inconsistent improvements in oxygen and carbon dioxide arterial tensions have been reported.^{1,3-5} The objectives of our study were to determine the cardiopulmonary effects of etorphine in immobilized white rhinoceros and changes associated with intravenous administration of butorphanol.

Etorphine (1000-1250 kg, 2.5 mg; 1250-1500 kg, 3.0 mg) immobilized rhinoceros developed hypoxemia ($\text{PaO}_2 = 25 \text{ mmHg}$) and hypercapnia ($\text{PaCO}_2 = 76 \text{ mmHg}$). Preliminary data analysis suggests that these blood gas values were not due to hypoventilation, but rather a marked increase in both alveolar-to-arterial oxygen gradient (P(A-a)O_2) and oxygen consumption due to an increase in metabolic rate. Intravenous administration of butorphanol (10 times the etorphine dose, mg) resulted in improved arterial oxygen ($\text{PaO}_2 = 25-48 \text{ mmHg}$) and carbon dioxide ($\text{PaCO}_2 = 76-62 \text{ mmHg}$) tensions. Minute ventilation, P(A-a)O_2 , physiologic dead space and alveolar ventilation fractions did not change significantly; however, there was a decrease in oxygen consumption associated with reduced skeletal muscle activity (tremors). Contrary to previous observations, these results suggest that improved blood gas values in etorphine immobilized white rhinoceros following butorphanol administration were not due to improvements in respiratory function, but rather as a result of changes in metabolic oxygen requirements.

Key words: Blood gases, butorphanol, cardiopulmonary, *Ceratotherium simum*, etorphine, metabolism, white rhinoceros

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