A comparison of the effects of carbon dioxide and medical air for abdominal insufflation on respiratory parameters in sheep undergoing sedated laparoscopic artificial insemination

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Laparoscopic artificial insemination (LAI) has better conception rates and utilizes semen more efficiently when compared to conventional trans-cervical approach and can be performed under light sedation in a hospital or field setting. The most commonly used insufflation gas is carbon dioxide (CO2) because it rapidly diffuses into blood and can be expelled via the lungs, but filtered air has been suggested as a safe and economical alternative. Our goal was to evaluate the effects of these two insufflation gases on respiratory parameters such as partial pressure of arterial oxygen (PaO2), partial pressure of arterial carbon dioxide (PaCO2), and arterial blood pH. Since air does not readily diffuse into the blood stream, we hypothesized that abdominal insufflation with medical air will have improved respiratory parameters when compared to insufflation with CO2 in sheep undergoing sedated LAI procedure.

Each animal underwent estrus synchronization for timed artificial insemination two weeks prior to, and fasted for at least 24 hs before the day of the procedure. Thirty-four sheep were randomly selected and enrolled in the study with owner permission. Each animal was assigned a participation number, which was randomized to one of two treatment groups: CO2 or medical air. The ear was clipped, steriley prepared, and local anesthetic was applied to aid in placement of a 20 gauge arterial catheter, which was then utilized for serial arterial blood gas sampling. Blood samples were obtained at baseline (T0), after sedation (T1), two minutes after being placed in Trendelenburg position (T2), five minutes post-abdominal insufflation (T3), and 15 minutes after the procedure was completed and patient had been returned to a standing position (T4). Arterial blood gas samples were collected in heparinized syringes, stored on ice, and batch run within 1 to 2 hs of collection. These samples were analyzed on a Stat Profile pHOx Ultra blood gas analyzer.

A t-test showed that there was no statistical difference between the two insufflation gases when comparing changes in PaCO2, PaO2, and pH at pre- and post-insufflation times points (P>0.005). Values for PaCO2, PaO2, and pH that may result in clinically significant consequences were defined prior to data collection. These were defined as an increase in PaCO2 >10%, a decrease in PaO2 >10%, or a decrease in pH >5%. There was also no difference between CO2 and medical air in the number of sheep who experienced clinically significant changes.

There appears to be no statistical or clinically significant difference between CO2 and medical air as insufflation gases, when evaluating their effects on oxygenation, ventilation, and acid-base parameters in sheep undergoing sedated LAI. Medical air may be a comparable and economical alternative to the commonly used CO2, especially if it is easily available with the use of a filtration system. It is worth noting that 30% of the sheep in both groups became clinically hypoxemic (PaO2<70 mm hg) and supplemental oxygen via facemask may be warranted during LAI procedures. None of the study participants in either group developed any post-surgical complications such as peritonitis or signs of systemic or local infection following the procedure.

**Keywords:** Laparoscopic artificial insemination, sheep, carbon dioxide, medical air, blood gas