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Evaluation of thoracic radiographic in full-term and premature lambs

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Introduction

Immediately after the birth, the airways are rapidly cleared of liquid to allow the onset of air breathing. This initiates a cascade of physiologic changes to enable the lung to adapt to gas exchange. Pulmonary fluid production decreases over the last few days before natural delivery. Radiographs can help to evaluate the type, severity, and location of pulmonary disease. The infiltrates can be characterized as interstitial, alveolar, or bronchiolar patterns and as focal or diffuse. Interpretation of thoracic radiographs of the neonate can often be challenging because immature lungs can appear radiographically similar to diseased lungs. Extensive alveolar patterns generally indicate a severe respiratory disorder (atelectasis, respiratory distress syndrome, pneumonia etc.), while the interstitial pattern commonly suggests an earlier or milder form of disease.

The aim of this study was to describe and compare the thoracic radiographic pattern changes in full-term and premature lambs.

Materials and Methods

We evaluated 36 lambs divided into 5 groups. In the NORMAL group (n = 9) lambs were born by normal delivery; and 4 different premature groups (PRE, DEX, SURF, and SURF+DEX), were delivered by cesarean section (137 days). Each group received a different treatment: PRE (n = 6) lambs received no treatment; DEX (n = 9) ewes received dexamethasone (16 mg/IM) 36 hours before surgery; SURF (n = 6) lambs were administered surfactant by intratracheal instillation (100 mg/kg); immediately after birth, and SURF+DEX (n = 6) ewes received dexamethasone and the lamb received surfactant. Lateral thoracic radiographs were taken at birth (M0), 24 hours (M24), and 48 hours (M48) after birth using a portable x-ray machine. All radiographs were made at 40kVp and 2 mA at a 100 cm focus-film distance. Fisher's exact test was used to determine if there were any differences between the groups in each moment; significance was set at $P < 0,05$. All changes were grouped to perform the statistical analysis, so we have lamb with or without radiographic changes.

Results

Radiographic changes depended on the group at M48 ($p = 0.0057$). At birth (M0) the radiographs in the SURF group revealed 100% (6/6) pleural effusion. Radiographic changes were noted in NORMAL 44.44% (4/9), PRE 83.3% (5/1), DEX 66.7% (6/9) and SURF+DEX 100% (6/6) groups.

At M24, 55.6% (5/9) of NORMAL, 75% (3/4) of PRE, 57.1% (4/7) of DEX, and 100% (5/5) of SURF+DEX lambs showed changes.

After 48 hours (M48), 77.8% of NORMAL lambs showed no changes, 75% (3/4) of PRE lambs showed changes in alveolar patterns, and 85.7% (6/7) of DEX lambs showed changes in alveolar patterns (4/6), bronchial patterns (1/6), and interstitial, alveolar and bronchial patterns (1/6). The SURF+DEX lambs (100%; 5/5) showed changes in interstitial and alveolar patterns (3/5), and interstitial, alveolar, and bronchial patterns (2/5).

All deaths occurred before 24 hours of life. Two lambs died in each of the PRE and DEX groups, 6 (100%) died in the SURF group, and 1 died in the SURF+DEX treatment group.

Significance

We conclude that treatment using only surfactant has a poor prognosis. A period of 48 hours for lambs born by normal delivery was sufficient to remove the lung fluid, while the premature lambs still showed changes in the thoracic radiographic patterns.