COMMUNICATION

Effect of Mycoplasma hyopneumoniae and fumonisin B₁ toxin on the lung in pigs

Roland Pósa¹, Melinda Kovács¹, Tamás Donkó², Judit Szabó-Fodor¹, József Mondok¹, Péter Bogner², Imre Repa², Tibor Magyar³

¹Department of Physiology and Animal Hygiene. Kaposvár University, Hungary
²Institute of Diagnostic Imaging and Radiation Oncology. Kaposvár University, Hungary
³Veterinary Medical Research Institute. Hungarian Academy of Sciences, Budapest, Hungary

Corresponding author: Dr. Roland Pósa. Department of Physiology and Animal Hygiene. Kaposvár University, HU 7400 Kaposvár, Guba S. u. 40. Hungary – Tel. +36 82 505 970 – Fax +36 82 505 970 – Email: posa.roland@ke.hu

ABSTRACT - The authors examined the combined effect of Mycoplasma hyopneumoniae (Mh) and fumonisin B₁ (FB₁) mycotoxin in pigs. Computed tomography (CT) was applied to follow up the pathological events in the lung. Piglets were infected with Mh, or treated with FB₁, or both infected and treated with Mh and FB₁. The Mh infection produced lung lesions in all piglets the severity of which was increased by FB₁. The CT is a suitable method for studying the pathological conditions in the lower respiratory tract of swine.

Key words: Mycoplasma hyopneumoniae, Fumonisin B₁, PRDC, Computed tomography.

Introduction – Porcine Respiratory Disease Complex (PRDC) is one of the main health concerns of modern swine production (Halbur, 1996, Brockmeier et al., 2002). In this study we examined the possible synergy between an important respiratory pathogen, Mycoplasma hyopneumoniae (Mh) and fumonisin B₁ (FB₁) mycotoxin produced by Fusarium verticillioides mould on the lung of the pigs. The predisposing role of FB₁ toxin may be hypothesized but it has not been thoroughly studied before. Computed tomography (CT), a modern imaging technique, was applied to follow up the pathological events in the lung.

Material and methods – Twenty-eight piglets were used which were weaned at the age of three days and then transported to the animal facility (day 0 of the study). The animals were fed a milk-replacer until day 16 and solid feed from day 7 until the end of the study (day 58). Piglets were assigned to four groups: Group 1: uninfected untreated controls, Group 2: treated with FB₁, Group 3: infected with Mh, Group 4: infected with Mh and treated with FB₁. Group 2 and 4 were fed a FB₁-contaminated feed (20 mg/kg) from day 16 until end of the experiment. Group 3 and 4 were infected with Mh (strain...
Mp 496) on day 30. The inoculum was prepared by suspending 1.5 g Mh containing lung tissue in 13.5 ml phosphate buffered saline (pH 7.2). Pigs were inoculated intra-tracheally with 0.5 ml of the suspension containing 109 colour-changing units/ml. *Fusarium verticillioides* strain MRC 826 was directly inoculated onto soaked, autoclaved, whole maize kernels. The inoculation was performed by standard spore suspension (1x10^6/ml), the culture was incubated at 25ºC for 5 weeks. To maintain the optimal a_w of approximately 1.00, the evaporated water was re-filled weekly. The dried culture was added to the diet to achieve 20 mg/kg feed FB1 content (Fodor et al., 2006). CT images were acquired at days 16, 30, 44 and 58 using a SIEMENS Somatom Emotion 6 multislice CT scanner. During the experiment body weight, body temperature, clinical signs were recorded. At the end, the pigs were humanly killed and lung lesions were examined post mortem. At necropsy lung lesions were evaluated as described by Straw et al. (1989). The CT images were analysed by Medical Image Processing V1.0 software. To assess the difference in the lung lesions between groups CT images of affected and non affected areas were compared (non air containing lung areas/air containing lung areas X 100). A comparison was also made between CT images and the gross pathological findings concerning the extension and characteristics of lung lesions. The means were tested using analysis of variance with SPSS for Windows 10.0 (1999) software.

**Results and conclusions** – No significant differences in body weight gain between groups were observed. In the two Mh infected groups (3 and 4) higher body temperature (>39,5°C) was recorded after day 31. From day 37 the infected animals showed clinical signs (coughing, laboured breathing and huskiness). CT examination did not reveal lesions in the negative control pigs (group 1) and the FB1-treated group (group 2) suggesting that the toxin did not induce macroscopic lesion at this dose level (Figure 1).

In the Mh infected groups (group 3 and 4) lung lesions were found in all animals on day 44. The most pronounced lesions were observed in the cranial, middle, and the accessorial lung lobes and in the front of the caudal lobe. The lung lesions appeared first around the small respiratory airway passages, later whole lobules and lobes became affected. Necropsy did not reveal lung lesion in the negative control pigs (group 1). In group 2, mild interstitial edema was observed in four animals. In the Mh infected groups (group 3 and 4) we found acute catarrhal pneumonia in all animals. The macroscopic lung lesions were more pronounced in
group 4 (mean 19.71, SD 8.3, min 8, max 31) than in group 3 (mean 30.43, SD 16.09, min 12, max 50). Significant differences were shown between non-infected and infected groups by CT evaluation (Figure 2).

The Mh infection produced lung lesions in young piglets that were increased by treatment with FB1 toxin. The only lethal case and the highest rate of lung lesions were found in group 4 that received FB1-toxin treatment beside the bacterial infection indicating that the FB1-toxin increased the severity of pneumonia caused by the bacterial pathogen. These findings confirm the idea of PRDC that various factors may act in harmony to produce pneumonia. Our results also indicate that CT can be applied for studying the pathological conditions in the lower respiratory tract of swine.

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