Histopathological Features of Amniotic Fluid-Derived Substances in the Lung of Foals

Takumi Kanemaru,* Mikihiro Kaneko,* Toyohiko Yoshihara,* Mitsuhiro Hasegawa* and Yoshio Tomioka*

The lung of 10 foals from 1 to 13 days of age were examined histopathologically. The foals consisted of 7 Thoroughbreds and 3 Anglo-Arabs, or 6 males and 4 females. As a result all the lungs contained such eosinophilic substances derived from amniotic fluid (amniotic fluid-derived substances) as similar to those observed in the lungs of aborted equine fetuses. The amniotic fluid-derived substances caused localized lesions of aspiration pneumonia in foals 5 days or more of age. They were also considered to have been eliminated from the bronchi or absorbed into the alveolar wall.

Key words. amniotic fluid, foal, pathology, pneumonia

The lungs of foals and aborted equine fetuses were examined pathologically in order to clarify respiratory diseases which have frequently occurred in foals.

The presence of amniotic fluid-derived substances in the pulmonary tissues has been reported in pathological examination of the lung of aborted fetuses.1) In the present study, the lung was examined histopathologically in foals to clarify the histopathology of localized pneumonia, which seems to be related to the amniotic fluid-derived substances in the pulmonary tissues.

Materials and Methods

The subjects used were 10 dead foals, including those which died soon after birth and those 13 days of age. Such respiratory signs as hyperthermia, coughing, and mucous nasal secretion were absent in them when examined by clinical auscultation. Of the foals, three were 1 day old, one was 2 days, two were 3 days, and four were 5 to 13 days. The foals consisted of 7 Thoroughbreds and 3 Anglo-Arabs, or 6 males and 4 females.

Table 1. Histopathological examination of foals

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Breed</th>
<th>Sex</th>
<th>Age (days)</th>
<th>Clinical diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AA</td>
<td>F</td>
<td>1</td>
<td>weakness</td>
</tr>
<tr>
<td>2</td>
<td>TH</td>
<td>M</td>
<td>1</td>
<td>weakness</td>
</tr>
<tr>
<td>3</td>
<td>AA</td>
<td>F</td>
<td>1</td>
<td>weakness</td>
</tr>
<tr>
<td>4</td>
<td>AA</td>
<td>M</td>
<td>2</td>
<td>muscular degeneration</td>
</tr>
<tr>
<td>5</td>
<td>TH</td>
<td>F</td>
<td>3</td>
<td>weakness</td>
</tr>
<tr>
<td>6</td>
<td>TH</td>
<td>M</td>
<td>3</td>
<td>weakness</td>
</tr>
<tr>
<td>7</td>
<td>TH</td>
<td>M</td>
<td>5</td>
<td>weakness</td>
</tr>
<tr>
<td>8</td>
<td>TH</td>
<td>M</td>
<td>6</td>
<td>difficulty in standing</td>
</tr>
<tr>
<td>9</td>
<td>TH</td>
<td>F</td>
<td>9</td>
<td>arthritis</td>
</tr>
<tr>
<td>10</td>
<td>TH</td>
<td>M</td>
<td>13</td>
<td>icterus neonatorum</td>
</tr>
</tbody>
</table>

Clinically, six showed weakness, one muscular degeneration, one difficulty in standing, one arthritis, and one icterus neonatorum (Table 1).

The lungs were obtained from the 10 foals, in which no lesions were observed in the pulmonary or visceral pleura by macroscopic examination or palpation of solid mass.

Immediately after the macroscopic examination, the entire lung was fixed for histopathological examination. A 10% buffered neutral formalin solution was infused into the trachea. After fixation, specimens were collected from five areas by cutting along the bronchial bifurcations on the frontal plane. These areas were the anterior lobe, the anterior area of the posterior lobe, two central areas of the posterior lobe, and the posterior area of the posterior lobe. They were obtained at 38 sites of the five areas. They were embedded in paraffin and cut into sections 6 μm thick, which were
stained. Staining was done with hematoxylin and eosin and by Atwood's method for amniotic fluid embolism staining, Gram's staining, Weigert's fibrin staining, PAS staining, colloidal iron staining, Masson trichrome staining, and elastica van Gieson's staining.

Results

Amniotic fluid-derived substances of various shapes were observed. They were classified morphologically into four types in essentially the same manner as those observed in the pulmonary tissues of aborted equine fetuses. They were distributed densely or scattered in an area extending from the bronchioles to the alveoli in all the subjects.

In the alveoli where these substances were present, alveolar macrophages and neutrophils infiltrated, surrounding the substances derived from amniotic fluid (Figs. 1 and 2). These substances were also rarely observed in the alveolar macrophages (Fig. 3). The alveolar epithelium of these areas was slightly enlarged. The alveolar wall was thickened due to repletion with blood capillaries or infiltration with reticuloendothelial cells (Cases 7–9). The alveolar wall was full of collagenous
fibers in some foals (Cases 8-10, Fig. 4). Some granular substances derived from amniotic fluid were contained in it.

Alveolar macrophages alone sometimes infiltrated slightly around amniotic fluid-derived substances in the alveoli in Cases 5 and 6. In Cases 1-4, in which these substances alone were shown in alveoli without alveolar infiltration, distention insufficiency was observed in some parts of the alveoli.

In an area extending from the bronchi to the bronchioli, amniotic fluid-derived substances were accompanied with alveolar macrophages and neutrophils.

Discussion

Histopathological examination revealed the presence of amniotic fluid-derived substances similar to those observed in the lungs of 10 foals which died at 1 to 13 days of age.1) In the foals no clinical symptoms of respiratory diseases were manifested, or no lesions were shown in either pulmonary or visceral pleura when examined by macroscopic observation and palpation of solid mass. Histopathologically, however, amniotic fluid-derived substances were present in association with a tissues reaction in the pulmonary tissue in 4 foals five or more days of age. These pathomorphological changes in the lung showed a localized feature of aspiration pneumonia.2-4) The remaining 6 foals 1 to 3 days of age had these substances distinctly in the pulmonary tissue, but reactive changes were hardly observed around the substances. This fact suggested that the substances might have caused a vital foreign body-like reaction unless they were secreted or absorbed from the bronchial or alveolar wall quickly within 5 days after birth. In addition, if the lung contains such substances, it will be likely to be affected with pneumonia (i.e., bronchial pneumonia due to bacterial infection that frequently occurs in foals) when postnatal conditions are poor.

As for human beings, on the other hand, there are some reports on pulmonary diseases due to aspiration of amniotic fluid-derived substances in infants.5,6)

Acknowledgments

The authors wish to thank the Hidaka Livestock Hygiene Service Center, the Hidaka Light Horse Agricultural Cooperative Association, and the Hidaka Agricultural Aid Association for cooperation in collecting foals for the present study, and Dr. M. Oikawa, chief researcher, of the Equine Research Institute, for his helpful suggestion. They also wish to thank Mr. K. Kobayashi, Mr. M. Takaya, Miss A. Koshiyama, technical staff members of their institute, for great help during this study.

Literature Cited

Histopathological Features in Lung of Foals

要約

幼駒における羊水物質による肺の病理組織像：兼丸卓美*・兼子樹広*・吉原豊彦*・長谷川克広*
富岡義雄*（*日本中央競馬会競馬総合研究所）——幼駒10例の肺を病理組織学的に検索した。日齢
は生後1日齢から13日齢であった。種類別ではサラブレッド種7例、アングロアラブ種3例、性別で
は雄6例、雌4例であった。肺の病理組織学的検索の結果、幼駒において流産胎仔で見られたと同様
の羊水物質がみいだされた。羊水物質は、生後5日齢以上の症例における吸入性あるいは吸収性肺炎
の限局性の像を惹起していた。また、この羊水物質は、気管支から排出あるいは肺胞壁から吸収され
るものと思われた。

— 55 —