Pathology of Aspiration Pneumonia in Mice

Kanji YAMASAKI

Chemical Biotesting Center, Chemicals Inspection & Testing Institute, 3-822, Ishi, Hita, Oita 877, Japan

(Received 12 October 1984/Accepted 30 April)

A aspiration pneumonia caused in 3 female mice by food inhalation was examined histopathologically. Dark-red areas were observed macroscopically on the uncut lungs. The change was more severe in the superior and post-caval lobes of the right lung and the anterior part of the left lung. Microscopic examination revealed various-sized foreign bodies (inhaled food particles) accompanied by inflammatory cells and microorganisms in the tracheal lumen and the bronchiolar and alveolar spaces.

Spontaneous and experimental aspiration pneumonias have been reported in domestic and laboratory animals [1-5, 7-11, 13, 14], but pneumonia caused by food has been described only in pigs and calves [3, 8, 13, 14]. Although food-derived bone fragments were found in the lungs of the rat, hamster, rabbit, and guinea pig, the lungs of these animals showed no pneumonic change [6]. There has been no reports on aspiration pneumonia in mice. I encountered the disease in 3 of 640 mice and this paper describes the histopathologic features of the aspiration pneumonia caused by food inhalation in these 3 mice.

Materials and Methods

Three female ICR mice are the subjects of this study. They died spontaneously at the age of 271 days (No. 30), 703 days (No. 292), and 734 days (No. 339), and the postmortem examination revealed macroscopic pneumonia. The 3 animals were members of a group of 640 mice that had been placed in plastic cages—5 animals per cage—and kept in barrier system animal rooms under specific pathogen free conditions. The animals had been fed autoclaved pelleted laboratory feed for the mouse (CMF: Oriental Yeast Co., Tokyo) and water ad libitum.

After a gross post-mortem examination, the main organs were fixed in 10% neutral formalin, embedded in paraffin, and stained with hematoxylin and eosin (HE). Selected sections of the lungs were also stained with Azan, periodic acid-Schiff (PAS), and Weigert stain. In addition, a feed pellet was sectioned by a routine procedure and stained with HE. The superior, inferior, and post-caval lobes of the right lung, and the anterior and posterior parts of the left lung were examined histopathologically. Polariscopic examination was used to identify the foreign bodies in the lung.

Results

I. Macroscopic findings: Two animals (Nos. 30 and 292) showed a gross pulmonary change, i.e., the uncut lung had dark red areas, which were sharply demarcated from the macroscopically normal areas.
The abnormality was greater in the hilar region of the lungs and was more severe in the superior and post-caval lobes of the right lung, and the anterior part of the left lung. The other animal (No. 339) showed a similar change, but to a lesser extent, in the superior and post-caval lobes of the right lung.

The esophagus and stomach were dilated with food. No noticeable abnormality was seen in any other organ of any animal.

II. Microscopic findings: The histopathologic changes observed in the individual animals are as follows.

No. 30 The pneumonic change occurred particularly in the terminal and respiratory bronchioles and alveoli (Table 1). The most characteristic change was the presence of foreign bodies of various sizes: large particles in the terminal bronchioles reached a maximum diameter of 570 μm and those in the alveolar ducts and alveoli reached 40 μm (Table 2). The particles, birefringent with polarized light and diffusely positive with PAS and Weigert stain, were identified as components of the food used. The particles in the lung were infiltrated with neutrophils, macrophages, foamy cells, and erythrocytes (Figs. 1 and 2). Macrophages with Gram-stain positive bacteria were also seen around the particles some of which were ingested by the macrophages. The bronchiolar epithelium was hyperplastic or desquamated; the bronchiolar epithelium and alveolar walls were destroyed at points of contact with large particles. The slightly thickened alveolar septa and edematous interstitium were infiltrated with neutrophils and histiocytes. Further, congestion, hemorrhage, and emphysema were present to a greater or lesser extent in all lobes.

The tracheal lumen contained foreign...
bodies, degenerative epithelial cells, neutrophils, macrophages, erythrocytes, and microorganisms (Fig. 3). The lumen of the esophagus was dilated with foreign bodies (Fig. 4). Other organs, including the brain, were normal.

No. 292 The changes were more advanced than they were No. 30 and were severe in the superior and post-caval lobes of right lung, and the anterior part of left lung (Table 1). The foreign bodies were numerous in the terminal and respiratory bronchioles, and alveoli and were associated with degenerating neutrophils, macrophages, giant cells, and microorganisms (Table 2). Destruction of the bronchiolar epithelium and alveolar walls due to inhaled particles characterised this case. Some bronchioles in which no foreign bodies was demonstrated contai-
ned inflammatory cells. The alveolar spaces were filled with a large number of macrophages and neutrophils.

The changes of the trachea and esophagus were almost the same as those in No. 30. The other organs were normal. No. 339 The changes, observed in the superior and post-caval lobes of right lung, were the least severe of the three cases (Table 1). The foreign bodies were present in the terminal and respiratory bronchioles and alveoli accompanied by a number of microorganisms (Table 2).

The changes of the trachea and esophagus were essentially the same as observed in the other two cases. The other organs were normal.

**Discussion**

Pneumonia accompanied by foreign bodies has been reported in domestic and
laboratory animals [1,3,8-14]. Among these reports, spontaneous aspiration pneumonia caused by feed is restricted to pigs [3,8,14] and calves [13]. Apparently, no reports of spontaneous aspiration pneumonia in mice have been published.

The principal histopathological changes observed in the present study were purulent bronchiolitis and alveolitis, which was reported in pigs [3,8,14], calves [13], and rabbits [11]. Smith and Hayward [8] demonstrated the same lesions caused by the aspiration of milk in gnotobiotic piglets. These authors found paper that the lesions in the lung progressed in cases in which microorganisms existed compared with cases in which only the foreign bodies were found. Furthermore, some reports suggested that the extent and severity of airway damage were depended on secondary infection by microorganisms [4,5,9-11]. The microorganisms possibly caused deterioration of the pneumonic lesions in the present cases as well. Our findings indicate that the microorganisms were capable of passing the trachea and reaching the lung.

The reason why the food particles were inhaled in the first instance is not clear, but the dilation of the esophagus and stomach should be taken into consideration as the important factor.

References

マウスにみられた吸引性肺炎の病理

山崎寛治
財団法人化学品検査協会日田研究所

3例のマウスについて飼料の誤嚥に原因する吸引性肺炎を病理学的に検索した。肉眼的変化は肺表面における赤黑色で示され、右肺の前葉、中間葉、左肺の前葉で重篤であった。組織学的に検査された異物は様々な大きさを示し、炎症性細胞さらには細菌塊を伴う気管、細気管支、肺胞に観察された。