Radiographic diagnosis of diaphragmatic hernia: review of 60 cases in dogs and cats

Changbaig Hyun

Companion Animal Science, School of Veterinary Sciences, The University of Queensland, St Lucia, QLD 4072, Australia

Sixty cases of diaphragmatic hernia in dogs and cats were radiologically reviewed and categorized by their characteristic radiographic signs. Any particular predilection for age, sex, or breed was not observed. Liver, stomach and small intestine were more commonly herniated. At least two radiographs, at different angles, were required for a valid diagnosis, because some radiographic signs were not visible in a single radiographic view and more clearly detectable in two radiographic views. In addition to previously reported radiographic signs for diaphragmatic hernia, we found that the location of the stomach axis and the displacement of tracheal and bronchial segments were also useful radiographic signs.

Key words: diaphragmatic hernia, radiography, traumatic, x-ray, diagnosis

Introduction

Diaphragmatic hernia is a protrusion of abdominal viscera through an opening in the diaphragm and is caused mainly by trauma such as an automobile accident and rarely by congenital defects. Radiographic diagnosis is the single most important diagnostic method of detecting diaphragmatic hernia in dogs and cats, although it is not always easy to identify diagnostic radiographic signs, especially in cases with pleural effusion. Therefore, a radiographic diagnosis should be accompanied by other diagnostic measures such as contrast studies and ultrasonography [1,4,5,8,9,10]. Loss of diaphragmatic line and cardiac shadow, abdominal gas shadow in thorax, and wasp-shaped abdomen are characteristic radiographic signs [2,3,4,6,7,11,12,14,15].

In this study, 60 clinical cases of diaphragmatic hernia were radiologically examined and categorized by their radiographic features. Additionally, several new radiographic signs have been included in our radiographic observation list for diaphragmatic hernia.

Materials and Methods

Sixty cases of diaphragmatic hernias from 1975 to 1997 at the Small Animal Teaching Hospital, the University of Queensland, were radiologically examined. Congenital diaphragmatic hernias (true diaphragmatic hernias) were not included in this study. Details of affected animals, main herniated organs and location of herniation were recorded. Characteristic radiographic signs were categorized by the following observation points:

i) Diaphragm: diaphragmaticolumbar recess, diaphragmatic line, divergence of the diaphragmatic crura, contrast between the diaphragm and liver
ii) Thorax: intrathoracic density, pleural effusion, mediastinal shift, pneumothorax, tracheal displacement
iii) Heart: cardiac displacement, cardiac shadow, cardiophrenic angle
iv) Lung: displacement of bronchial segment, lung shadow, pulmonary vascular marking, pulmonary vascular condition
v) Abdomen: Abdominal gas shadow, wasp-shape of abdomen, loss of abdominal organ shadow, cranial displacement of abdominal organ, loss of falciform ligament, stomach axis
vi) Miscellaneous: traumatic signs

Results

Animals

Forty-two cases were dogs (24 males, 17 females and 1 undetermined) and 18 were cats (9 males, 5 females and 4 undetermined). The age of affected animals varied from 7 weeks to 10 years (mean: 2.64 years old, dog: 2.63 years, cat: 2.66 years). The mean age of affected male animals was 3.71 years old (dog: 3.51 years, cat: 3.22 years), while that of female animals was 1.44 years old (dog: 1.49 years, cat: 1.44 years). Any particular predilection for either age, sex, breed or species was not observed.
Right side diaphragmatic hernias were more common, although a noticeable difference in the site of herniation was not observed (Table 1). The site of herniation could not be determined in 3 cases, because either only one radiographic view was available or severe pleural fluid accumulation was present. In 41 cases (68%), more than one organ was herniated (Table 1). Liver was the predominant herniated organ (85%), especially in right side hernias (96% but 65% in left side) whereas stomach was the prominent organ in the left side hernias (95% but 17% in right side; Table 1).

Regardless of the site of herniation, hernias involving the small intestine was more evenly distributed (42% in the right side and 50% of the left side; Table 1).

### Radiographic signs related to diaphragm

Decreased diaphragmaticolumbar recess (angle) was observed in 40% of the cases and more obvious in left side diaphragmatic hernias (60%) than any other side hernias (Table 2). Due to fluid accumulation, we were unable to determine the diaphragmaticolumbar recess in one of the cases. Loss of the diaphragmatic line was obvious in all cases, although it varied by radiographic views (Table 2). In some cases, partial loss of the diaphragmatic line was seen in lateral view but completely obliterated in the dorsoventral (D-V) view and vice versa. The diaphragmatic crura was diverged in 25% of the cases (Table 2) and was undetermined in some cases with pleural effusion. A loss of contrast between diaphragm and liver was also observed in all cases.

### Radiographic signs in thorax

Increased intrathoracic density was the most common intrathoracic sign (87%) seen on the radiograph, although this density could be decreased due to the herniated stomach gas shadow (8%; Table 3). Pleural effusion was predominantly found in the both and central side hernias (both side: 10/10, central side: 3/3; Table 3). In 58% of the cases, a distinct mediastinal shift was observed (35/60; Table 3), usually located at the opposite side of herniation. In 9 cases, this mediastinal shift was unable to determine due to a lack of D-V view (3 cases), poor positioning (1 case), fluid accumulation (2 cases) and severe abdominal organ prolapse.