CASE REPORT

Hepatocellular Carcinoma: Cause of Diaphragmatic Herniation in Canine

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Diaphragmatic hernia (DH) may be congenital or acquired. Most diaphragmatic defects reported in bovines are either traumatic in origin or have a history of advanced pregnancy or recent calving (Smith, 2002). DH may also occur as a result of progressive weakening of the diaphragm adjacent to a hardware perforation and reticuloperitonitis (Divers and Peek, 2008). There is meager literature on congenital diaphragmatic defects in horses and accidental, spontaneous rupture usually occurs from abdominal crushing, following blunt trauma or penetrating injuries to the abdomen and chest (Sasho and Dian, 2009). Cases of DH in canine are less frequently noticed. There is the occasional report of DH in canines due to a neoplastic growth like hepatocellular carcinoma. This communication reports a case of Rottweiler pup, which was presented with clinical signs of dyspnea and vomiting, that was tentative diagnosed as respiratory pathology and was subjected to further investigation and autopsy.

Case History and Clinical Observations

A 2-month old Rottweiler pup was presented at Teaching Veterinary Clinical Complex, Faculty of Veterinary & Animal Sciences, to treat major clinical symptoms like vomition and dyspnea. Other common clinical signs like increased shallow respiration, tachycardia, inappetence and lethargy were noticed on physical examination. However, the pup died before further investigation like CBC, serum biochemistry, ultrasonography, and radiographical examination. Hence autopsy was performed to rule out the cause.

Autopsy Findings and Discussion

The carcass was immediately necropsied on academic interest. During the post-mortem examination, impression smears were prepared for cytological examination from different cut surfaces of pathological nodular growth and fixed with absolute methanol. Smears were stained with Giemsa stain (Valenciano and Cowell, 2014). One cubic centimeter tissue sample was taken and fixed in 10% buffered formalin for histopathological examination. After overnight washing and fixative removal, the tissue sample was paraffin-embedded and stained with Haematoxylin and Eosin.

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A Necropsy study unveiled nodular growth that looks like liver, and a portion of liver along with varying lengths of small intestine were herniated in the thoracic cavity due to diaphragmatic rupture (Figure 1). Herniated nodular growth was highly congested, cherry red in colour, 07 cm in size and nodular in consistency (Figure 2A), and highly vascularized. Blood was oozed out from the cut surface of this growth. The right crus and central tendon of the diaphragm, along

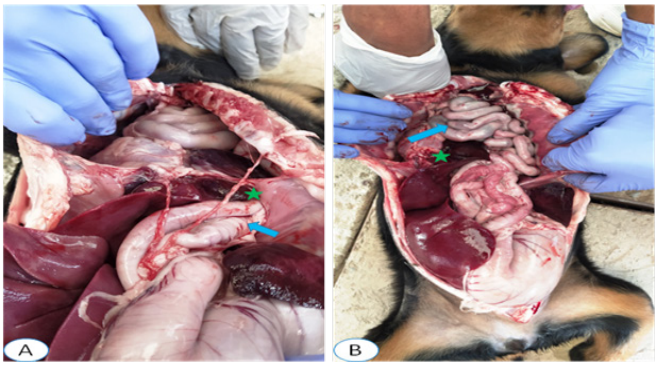

Figure 1: Diaphragmatic herniation in a pup: A. Liver lobe (asterisk) and intestine (arrow) herniated through diaphragmatic rupture, B. Liver lobe (asterisk) and intestine (arrow) in thoracic cavity

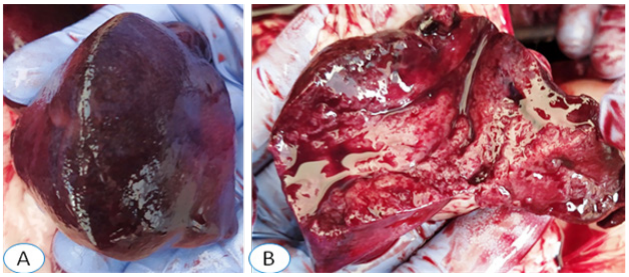

Figure 2: Hepatocellular carcinoma: A. Intact, B. Cut surface.

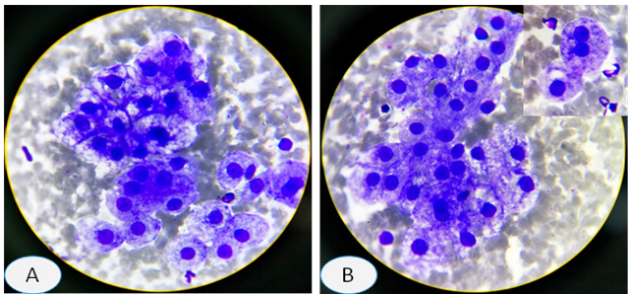

Figure 3: Hepatocellular carcinoma: A. Polygonal neoplastic hepatocytes showing basophilic, polymorphism and increased nuclear to cytoplasm ratio, B. Palisading arrangement and acinar pattern neoplastic hepatocytes and multinucleated giant cell (*in situ*).

with the esophageal hiatus, were intact (Figure 2B). The defect did not involve the pericardial sac. The lungs showed minimal evidence of inflammation with mild congestion. There was no any abnormality in the gross appearance or location of abdominal viscera, except the liver which showed hepatomegaly and mild congestion.

Cytological examinations revealed that nodular growth was hepatocellular carcinoma, which was characterized by basophilic, pleomorphic anisokaryosis, and anisocytosis polygonal neoplastic hepatocytes (Figure 3A). Cytoplasmic and nuclear pleomorphism with increased nuclear to cytoplasm ratio and mitotic figures were also noticed. Palisading arrangement neoplastic hepatocytes and giant cells were more significant and convincing characteristics of hepatocellular carcinoma (Figure 3B). Histopathologically, the tumor was characterized by a trabecular pattern of neoplastic cells.

Traumatic DH occurs following blunt force trauma to the abdomen, causing increased abdominal pressure. When this force is combined with an open glottis, the air-filled lungs deflate, causing a sudden increased pressure gradient across the diaphragm,-leading to rupture of the weaker muscular portions in the direction of the muscle fibers or tears along the attachments to the ribs (radial or circumferential tears) (Worth and Machon, 2005). In a study of 56 diaphragmatic hernias, circumferential tears were found in equal numbers of dogs and cats. However, radial tears were found in higher proportions in canines than feline (Garson *et al.*, 1980). In the present case, radial tear of the diaphragm may be due to combined effect of pressure and hepatocellular carcinoma with aberrant blunt force produced by sudden movement due to playing and jumping habit of pup. In this case, major clinical signs like rapid and shallow respiration and vomition were also in agreement with the findings of Anne *et al.* (2004) that labored breathing may vary from barely detectable to fatal, depending on the severity of the hernia.

DH often results in the stomach, small intestine, and splenic herniation (Worth and Machon, 2005). The displacement of the liver along with the small intestine in the present case was in accordance with the finding of Katie (2013), who described the displacement of organs depending upon the location of the diaphragmatic rupture, certain organs were herniated more frequently, with the liver being the most common. Right-sided DH often resulted in small intestinal and pancreatic herniation, while left-sided leads into the liver and small intestine displacement.

In general, hepatocellular carcinoma can be a rare cause of acquired DH in canines with respiratory distress like rapid and shallow respiration and vomition as major clinical manifestations.

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