

Surgical Correction of Peritoneopericardial Diaphragmatic Hernia with Hepatic Necrosis in a Himalayan Cat

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Abstract : A five months old, female Himalayan cat was referred to the Veterinary Medical Teaching Hospital at Konkuk University, because of suspecting peritoneopericardial diaphragmatic hernia (PPDH). After consecutive examination, the patient was diagnosed as PPDH and hepatic dysfunction. In spite of medical therapy for a month, the serum chemistry profiles for liver enzymes (aspartate transferase: 469 U/L, alanine transferase: above analysis, gamma-glutamyl transferase: above analysis) did not decrease to the normal range. In operation, some of liver was necrotized and was adhesive to diaphragm, these were gently dissected from thoracic structures, and resected. After debriding, the edges of the defect of diaphragm were closed with a simple continuous suture pattern. One month after operation, the cat had normal condition, recovery was uncomplicated, and the serum chemistry profiles for liver enzymes decrease to the normal range.

Key words : peritoneopericardial diaphragmatic hernia, liver necrosis, Himalayan cat

Introduction

Peritoneopericardial diaphragmatic hernia (PPDH) was first introduced in dogs in 1951⁸ and in cats in 1966¹. PPDH is an opening or hiatus between the abdomen and the pericardial sac^{3,4,7}. So abdominal organs and structures may be found in the pericardial sac. In humans the diaphragm forms one wall of the pericardial sac¹⁰. Rupture of the diaphragm in this area results in communication between the pericardial sac and peritoneal cavity¹¹. Therefore peritoneopericardial diaphragmatic hernia in humans may be either congenital or secondary to traumatic diaphragmatic hernia¹¹. But in dogs and cats this anomaly is always a congenital defect¹¹. So, PPDH are less commonly recognized by small animal clinicians than are traumatic diaphragmatic hernias. With this reason, the animals with PPDH may not be recognized easily by owners, if clinical signs dont happen.

Liver is the most frequently displaced organ, when PPDH is happened⁷. Liver in the pericardial sac can be torsional and adhesive to pericardial sac and diaphragm. After that, liver couldnt normally function.

This report is the occurrence and the successive medical and surgical therapy of PPDH with hepatic necrosis in a Himalayan cat.

Case

History and Physical findings

A five months old, female Himalayan cat was referred to the Veterinary Medical Teaching Hospital of College of Veterinary Medicine at Konkuk University, because of sus-

pecting peritoneopericardial diaphragmatic hernias. The cat had a history of anorexia, falling in lethargy and mild diarrhea. In physical examination there was mucous discharge from eye, nose, and mouth. The cat had painful palpations of the cranial abdomen. Body temperature (38.7°C) and respiratory rate (39 breaths/min) were normal. Tachycardia (210 bpm) was happened at the resting state. Heart sounds were clearly audible on the left side and muffled on the right side.

Hematologic and Serologic findings

In CBC, there was a leukocytopenia ($2.48 \times 10^3/\mu\text{l}$). Abnormalities on the serum chemistry profile included elevated values for liver enzymes (alkaline phosphatase (ALP): 889 U/L, aspartate transferase (AST): 94 U/L, alanine transferase (ALT): above analysis range, gamma-glutamyl transferase (GGT): above analysis range), elevated NH_3 : 225 $\mu\text{mol/L}$, and elevated total bilirubin: 1.8 $\mu\text{g/dl}$. Hypokalaemia: 2.2 mmol/L was also existed. Corona virus infection test was positive.

Radiological findings

Survey radiographs of the thorax revealed a enlarged, irregular cardiac silhouette that was smooth and globular in both the lateral and dorsoventral views. Loss of the diaphragmatic line was showed at the right side. The space occupied by the lungs was reduced markedly. The trachea was displaced dorsally so that it was parallel to the thoracic vertebra. The liver size in the abdomen was small. But the liver silhouette was continued though caudal thoracic cavity (Fig 1).

Ultrasonographic findings

Two-dimentional echocardiographic imaging showed the liver within the pericardial sac between the heart and the right chest wall. The discontinuity in the diaphragm was also seen (Fig 2).

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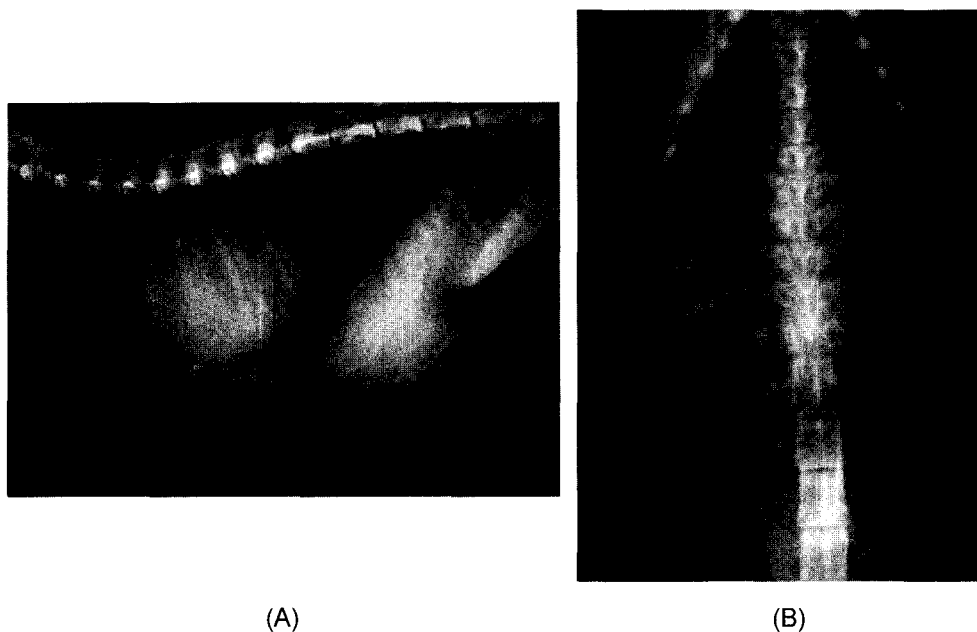


Fig 1. Thoracic radiologic evaluation before operation. An enlarged, irregular cardiac silhouette that was smooth and globular in both the lateral (A) and dorsoventral views (B). Loss of the diaphragmatic line was showed at the right side (B).

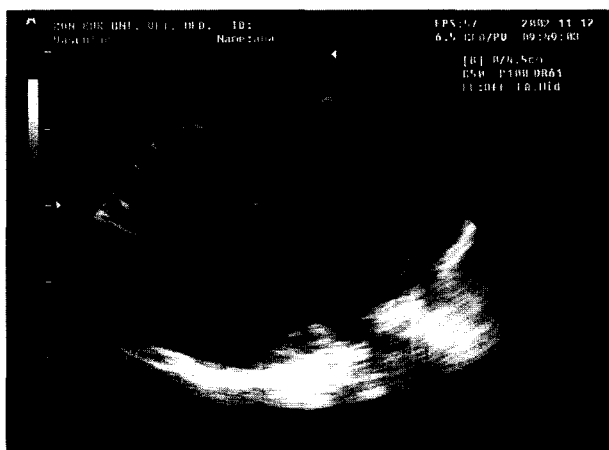


Fig 2. Echocardiographic imaging before operation. the liver within the pericardial sac between the heart and the right chest wall.

Medical treatment

5% glucose & isotonic saline (Dai han Pharm. Co. Ltd.) with hepacoma (Dai han Pharm. Co. Ltd.) (1:1) was administered intravenously for 8 days. Taurine (Samyang Pharma-chemicals. Co. 1 ml, i.v., b.i.d.) was injected 2 times a day for 2 days. Lactulose (Duphalac[®] syrup, Choongwae Pharma. corp., 1 ml, p.o., t.i.d.), Urazamide (Recover[®], Yuhan corporation, 25 mg/head, p.o., b.i.d.), amoxicilline (Dong wha pharm. Ind. Co. Ltd., 20 mg/kg, p.o., b.i.d.), Ursodesoxycholic acid (Uso-san, Korea united Pharm., 25 mg/head, p.o., b.i.d.) were administered. Liver function was evaluated every week.

One month later, the cat had normal condition, and all

hematological indexes were normal except liver enzymes (ALT: above analysis range, AST: 469 U/L, GGT: above analysis range). In spite of medical therapy for a month, the serum chemistry profiles for liver enzymes did not decrease to the normal range.

Surgical treatment and findings

Before surgery patient was hydrated with 5% glucose & isotonic saline with hepacoma (1:1) for 12 hours. Antibiotics (amoxicilline, Shin poong, 20 mg/kg, i.v.) and analgesics (Butorphan[®], Myungmoon pharm., 0.4 mg/kg, i.v.) were administrated. After anticholinergic (atropine sulfate, Kwang Myung pharm. Co. Ltd., 0.02 mg/kg, s.c.) was injected, anesthesia was inducted with thiopental sodium (Pentotal sodium 0.5gr. inj. Choong wae Pharm. Corp., 15 mg/kg, i.v.). With isoflurane (Rhodia Organique Fine Ltd., 0.5~2.5%) was maintained and mechanical ventilation was performed.

The entire abdomen and caudal two thirds of the thoracic cavity was prepared for aseptic surgery. The patient was placed in dorsal recumbency.

From the beside xyphoid process about 10 cm ventral mid-line abdominal incision was performed. Right medial lobe, Quadrate lobe and left medial lobe of liver was entered to the pericardial sac in the thoracic cavity via opened diaphragm. And Quadrate and left medial lobe was necronized and was abhesive to diaphragm. So these was gently dissected from thoracic structures, and resected. After debriding the edges of the defect of diaphragm was closed with a simple continuous suture pattern. We did not close the pericardial sac. During closing the diaphragm, an over-the-needle catheter attached to extension tubing, and a three-way stopcock and syringe was

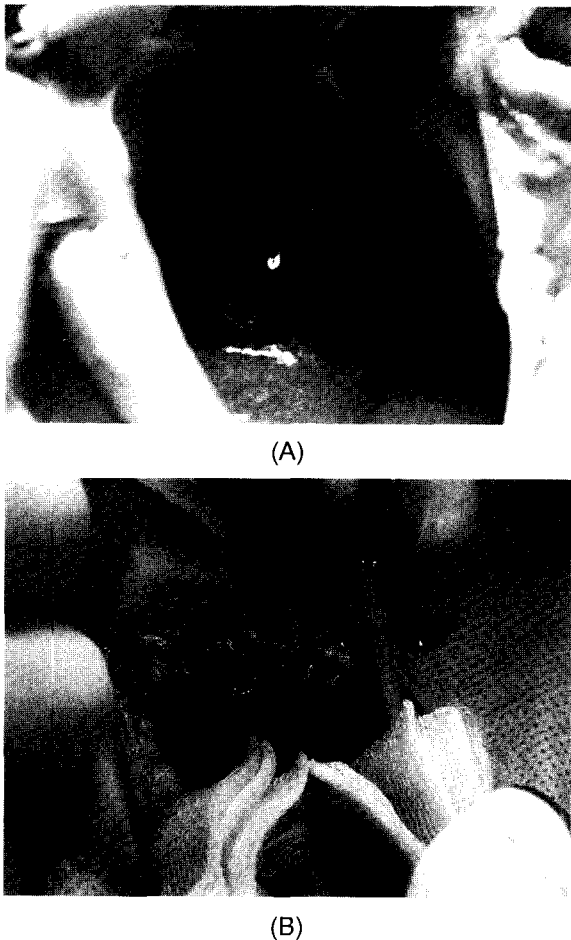


Fig 3. The Surgical treatment and findings. Quadrature lobe and left medial lobe of liver was entered to the pericardial sac in the thoracic cavity via opened diaphragm (A). After debriding the edges of the defect of diaphragm was closed with a simple continuous suture pattern (B).

placed through suture line for air to remove from the pleural cavity. Thereafter, abdominal cavity was closed (Fig 3).

Postoperative care and evaluation

The patient was monitored postoperatively for hypoventilation with patient monitor (ECG, respiration, body temperature) in intensive care unit and oxygen was provided for two days, because of potential complication of Reexpansion pulmonary edema (RPE). 5% glucose & isotonic saline with hepcoma (1:1) was administered intravenously for 5 days. Taurine 1 ml was injected 2 times a day for 5 days. Antibiotics (amoxicillin, Shin poong, 20 mg/kg, i.v., b.i.d.), and Beecom hexa (1 ml, Yuhan Co., Seoul, Korea, i.v., b.i.d.) was administered for 5 days. After that, Urazamide and Ursodesoxycholic acid were administered for 2 weeks.

A week later after operation, ALT (462 U/L), AST (159 U/L), ALP (105 U/L) and GGT (32 U/L) remarkably decreased. And a month later after operation ALT (84 U/L), AST (26 U/L),

ALP (159 U/L), and GGT (7 U/L) decreased to the almost normal range.

Discussion

Peritoneopericardial diaphragmatic hernia was first introduced in 1811, but the first clinical case was reported 1951¹². This is the most common of the congenital diaphragmatic hernias in dogs and cats³. Peritoneopericardial diaphragmatic hernia generally is diagnosed in young animals; median ages of the dogs and cats in one study were seven and nine months respectively¹¹. Male dogs are affected more often than females (2:1), whereas in cats there is an equal sex distribution¹¹. Clinical signs were referable to the respiratory, cardiovascular, and gastrointestinal systems described previously^{4,8,9}. Muffled heart sounds and tachypnea were the most common abnormal findings on physical examination¹¹.

Previously, diagnosis of peritoneopericardial diaphragmatic hernia was made by angiography, pericardiography, pneumoperitoneography, and gastrointestinal contrast studies¹¹. Currently, diagnosis is best made by thoracic radiography, echocardiography, and positive-contrast peritoneography. Echocardiography is the best mode for diagnosis because fluid and solid structures can be differentiated, and heart function and the presence of congenital cardiac defects also can be assessed¹¹. In this study, echocardiography was also most effective technique for diagnosis of PPDH. Liver in the pericardial sac was easily founded.

The most widely accepted theory regarding the embryogenesis of this defect is that the hernia arises because of faulty development or prenatal injury of the septum transversum⁷. This could be a result of a teratogen, genetic defect, or prenatal injury⁷.

The best treatment of PPDH is surgical correction¹⁰. So in this study, the patient was tried to surgical treatment. But liver did not function normally on the first serum chemical evaluation. For this reason, operation was postponed. Medical therapy for liver was tried for a month, the symptom did not improve. In this time, we thought this symptom couldnt be recovered with medial treatment, because dislocation of liver made liver dysfunction. With surgical correction of diaphragm, surgical correction of liver also need. In this study, liver was founded as necrosis, so we have to resect the part of necrotic hepatic lobes.

After operation, the patient had recovered without any complication. And the hepatic function was monitored carefully with medical therapy for liver for a month.

Conclusion

A five months old, female Himalayan cat presented treatment for peritoneopericardial diaphragmatic hernia. In spite of medical therapy for a month, the serum chemistry profiles for liver did not decrease to the normal range. One months later after surgical correction of diaphragm and surgical resection of

part of necrotic liver, the cat had normal condition, recovery was uncomplicated, and the serum chemistry profiles for liver enzymes decrease to the normal range.

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히말라얀 고양이에서 간괴사를 동반한 복막심낭횡격막 허니아의 외과적 치료

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요약 : 5년령의 암컷 히말라얀 고양이가 복막심낭횡격막 허니아가 의심되어서 건국대학교 수의과대학 부속 동물병원에 내원하였다. 일련의 검사를 실시한 후 환자는 복막심낭횡격막 허니아와 간기능 부전이 확진되었다. 그 후 한 달간의 약물치료에도 불구하고, 혈청화학검사에서 간효소 (aspartate transferase, alanine transferase, gamma-glutamyl transferase) 수치는 정상범위로 내려 가지 않았다. 이 환자는 수술 중에 간 일부가 횡격막에 유착되어서 괴사가 일어난 것이 발견되었고, 유착되고 괴사된 간 조직은 횡격막에서 조심스럽게 분리하여 절제하였다. 횡격막은 괴사된 부분을 잘 정리하고 난 뒤에 손상된 횡격막 부분을 simple continuous suture pattern으로 봉합하였다. 수술 후 한 달 뒤 환축은 정상적인 상태를 보였고 다른 복합증 없이 회복되었다. 그리고 혈청화학 수치 중 간효소 수치도 정상 범위로 떨어졌다.

주요어 : 복막심낭횡격막 허니아, 간괴사, 히말라얀 고양이