

## Vaka Takdimi

### THE CLINICOPATHOLOGICAL FINDINGS DUE TO A GRASS AWN (*HORDEUM SPP*) DETECTED IN THE RIGHT AURICLE OF A DOG

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#### Bir Köpekte Sağ Aurikulada Saptanan Pisi Pisi Otu'na (*Hordeum spp*) Bağlı Gelişen Klinik ve Patolojik Bulgular

**Özet:** Bu vakada 6 yaşındaki dişi Alman Puanter ırkı köpeğin sağ kalp aurikulasında saptanan pisi pisi otu'na bağlı gelişen lezyonlar değerlendirildi. Kliniğe abdominal distansiyon, ikterus, anoreksi ve halsizlik şikayetiyle getirilen köpeğin radyografisinde akciğer kaudal loblarında hipervaskularizasyon ile birlikte opaklaşma, trachea'da dislokasyon, hepatomegali ve splenomegali saptandı. Ekokardiyografide arteria pulmonalis ve sağ ventrikülde dilatasyon, interventriküler septumda paradoksiyal hareket izlendi. Hastada sağ kalp ve karaciğer yetmezliğinden şüphelenildi. Hastadan abdominal sentezle üç günde 1.5 litre sıvı alındı ve semptomatik tedavi uygulandı. Tedavinin başında genel durumu düzelmesine rağmen daha sonra giderek kötüleşti ve altıncı ay'da öldü. Yapılan nekropside karın boşluğunda 2 lt kadar modifiye transudat saptandı. Sağ kalp aurikulasında pisi pisi otu, akciğerlerin şişkin ve mozaik manzarası görünüm aldığı, karaciğerde de aşırı büyüme ve konjesyon saptandı. Histopatolojik incelemede kalp kasında nekroz, pisi pisi otu'na ait halka benzeri yapılar ve yabancı cisim dev hücreleri ile çok sayıda dejeneratif nötrofil lökositten oluşan abse alanları saptandı. Akciğerlerde sellüler ve irinli bronkopneumoni ve damarlarda tromboz gözlemlendi. Karaciğerde sinosidlerde dilatasyon ve şiddetli konjesyon, hepatositlerde atrofi ve nekroz izlendi. Ayrıca portal venlerde ve hepatic lenf damarlarında dilatasyon ve damar duvarlarında kollagen doku artışı saptandı. Sunulan bu olgu iç organlarda (akciğer, periton) nadiren görülen pisi pisi otunun sağ aurikulada saptanan ilk olgu olduğunu ve intrakaryak yabancı cisme bağlı olarak karaciğerde gelişen klinikopatolojik bulguların Budd-Chiari benzeri sendromu ile benzerlik gösterdiğini düşünmekteyiz.

**Anahtar Kelimeler:** Köpek, Pisi pisi otu, Sağ aurikula, Karaciğer, Budd-Chiari benzeri sendrom

**Summary :** In this case lesions that occurred due to a grass awn detected in the right auricle of the heart of a 6-year-old female, German Pointer were described. Presenting signs were abdominal distention, icterus, anorexia and lethargy. Radiography revealed hypervascularization and loss of contrast in caudal lung lobe, elevation of trachea, hepatomegaly and splenomegaly. The echocardiography revealed dilation of the pulmonary artery and the right ventricle and paradoxiyal septal motion. A presumptive diagnosis was made of liver and right heart failure. Abdominocentesis and symptomatic treatments were administered to the patient. However the patient did not respond to the therapy and gradually deteriorated and she died within a month.

At the necropsy transudate was observed in the abdominal cavity at an approximate amount of 2 lt. The grass awn was detected in the right auricle of the heart. The lungs were swollen and mottled. The liver was over-enlarged and congested. Histopathologically, myocardial necrosis was evident. Annular foreign bodies putative of grass awn, foreign-body giant cells with multiple nuclei and foci of abscesses with numerous degenerative neutrophil leukocytes were observed in myocardium. Cellular and purulent bronchopneumonia and thrombosis were typical in the lungs. Furthermore, portal venous vessels and hepatic lymphatics were dilated and collagenous fibrous proliferation was evident within the walls of the vessels.

**Key Words:** dog, grass awn, right auricle, liver, Budd-Chiari-like syndrome

## Introduction

Inflammation (purulent to pyogranulomatous) in various body sites of dogs and cats due to the migration of grass awns are called "grass awn disease" (2, 4, 9). In a study that has been done by Brennan and Ihrke (2) in USA, it has been found that 61% of all foreign bodies recovered from dogs and cats were of plant origin. These plants were determined to belong to *Hordeum spp.* and their migration in the body is passively facilitated by the animal's motion (2). Common sites affected include the external ear canal, interdigital skin, perineal area, nasal cavity, third eyelid and the paralumbar area. Occasionally grass awns may migrate from the nasal cavity to the lungs via trachea and to peritoneum by perforating the diaphragm (2, 5, 8). In human medicine, there are cases also reporting bronchiectasis and pneumothorax in children due to grass awn inhalation (1, 12).

Although grass awns have been detected in various body sites, no reference in the literature was made to the heart. Thus, we aimed to present the clinical and pathological findings due to a grass awn in the heart of a dog.

## Case History

### Clinical Findings

A 6-year-old female, German Pointer dog was brought to the department of the Internal Medicine with the presenting signs of inappetence and weakness. Clinical examination revealed abdominal distention, mucosal icterus, fever (40.8 °C), increase in respiratory and heart rates, venous distension, dyspnoea and hard vesicular sounds on

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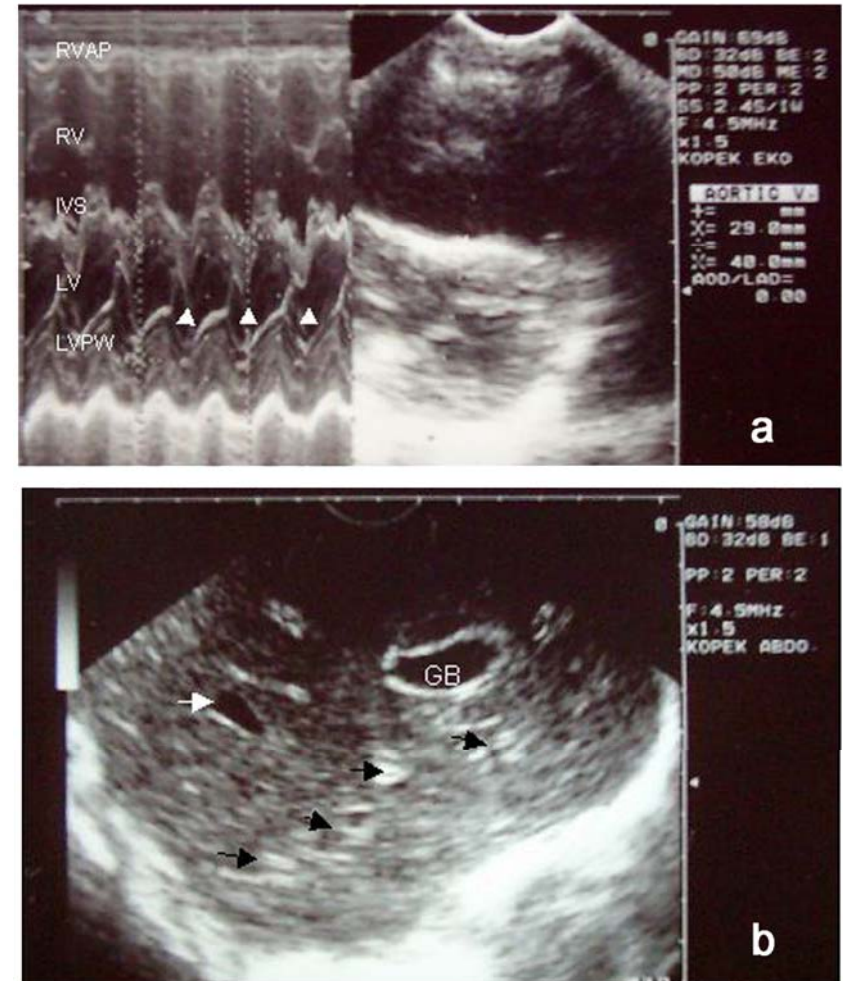
pulmonary auscultation. Abdominocentesis yielded fluid with a specific gravity of 1.016 and total protein concentration of 2.8 g/dl. Haematological values were as follows: RBC  $2.69 \times 10^6/\text{ml}$  [6-9x10/ml], PCV 16.8% [37-55%], WBC  $26.1 \times 10^3/\text{ml}$  [6-17x10/ml], PLT  $56 \times 10^3/\text{ml}$  [200-500x10/ml] and HGB 6.2g/dl [12-18g/dl]. Biochemical parameter in serum were; total protein 4,1g/dl [5.3-7.6 g/dl], albumin 2.9/dl [3.2 - 4.7 g/dl], AST 46 U/L [12-37 U/L], ALT 90 U/L [17-69 U/L], ALP 847 U/L [10-129 U/L], direct bilirubin 4.6 mg/dl [0.1 - 0.4 mg/dl], indirect bilirubin 2.3 mg/dl [0.1 - 0.3 mg/dl].

Radiography revealed loss of contrast in caudal lung lobes, hepatomegaly, splenomegaly, loss of abdominal contrast, tracheal elevation and cardiomegaly. Two dimensional and M- mode echocardiography revealed pericardial thickening, dilation of pulmonary artery and right ventricle and paradoxical septal motion. The end diastolic diameters of right ventricle (RDVD) and left ventricle(LDVD) were 40 mm (9-10 mm) and 29 mm (30-37 mm) respectively (Fig. 1a). Ultrasonography revealed thickening of the hepatic capsule, hepatomegaly, linear hyperechoic bands on the liver and thickening on the wall of the gall bladder and dilation of the hepatic veins (Fig. 1b). Liver and heart failure were suspected but the aetiology of fever and leukocytosis was unclear. Modified transudate of 1.5 litres was removed by abdominocentesis over 3 days and following this symptomatic treatments were administered to the patient. Isolyte and % 5 dextrose 10 mg/kg 5 days (Vilsan A.S. Ankara, Turkey), prednisolone, during first 10 day-period 1 mg/kg and the further 10 day-period 0.5 mg/kg I.M, SID (Prednol-L amp. 40 mg; Mustafa Nevzat İlaç San. A.S. İstanbul, Turkey), amoxicillin/clavulonate 10mg/kg/ I.M, BID, 1 week-period, (Synulox fl; Pfizer, İstanbul, Turkey), Vit E 30 mg/kg/10days/ orally, SID (Evicap caps. 300 mg; Koçak İlaç San. A.S. İstanbul, Turkey), frusemide 2 mg/kg/10 days/ I.M, BID (Lasix amp. 20 mg; Hoechst, İstanbul, Turkey), propranolol 0.3 mg/kg/ orally, BID (Inderal tab. 40 mg; Sanofi - Dogu İlaç A.S. İstanbul, Turkey). However the patient did not respond to the therapy, and the dog gradually deteriorated and she died within a month.

#### Necropsy Findings

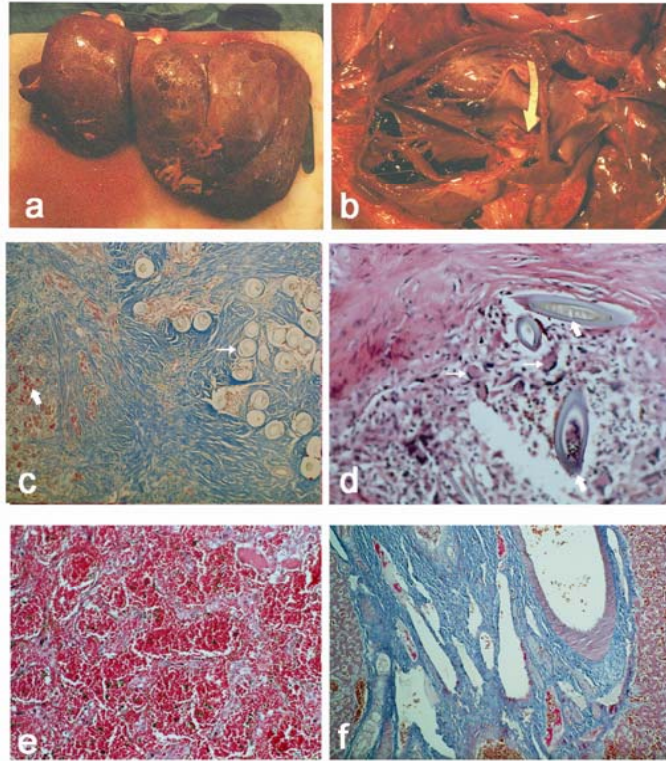
A systematic necropsy was performed. At postmortem inspection, approximately 2 liters of reddish colored fluid (modified transudate) was found in the abdomen. The liver was observed to be extremely enlarged and friable in consistency and it was covered with fibrin tags (Fig.2a). 200 ml of reddish colored fluid was present in the thoracic cavity and fibrin tags adhered to the pleura were seen. Marked enlargement of the right ventricle of the heart and an increase in the volume of pericardial fluid were observed. The heart was extremely enlarged leading to the compression of the caudal vena cava. In the right auricle a grass awn with a black stem and a spike-like head was seen embedded next to the entrance of the vena cava (Fig.2b). On the wall of the auricle, there was a tissue proliferation which had encircled the weed. In the auricle, on the

opposite side of the wall to where the weed was embedded, there was a nodule-like proliferation which was dull white in color. The tricuspid valve was thickened and black in color. In the right ventricle, where the chordae tendineae were located, scar tissue of whitish color was observed. The lungs were swollen and dull white in color.



**Figure 1. a:** M-mode recording at ventricular level from the dog, showing right ventricular dilatation and paradoxical septal motion. **b:** Linear bands of increased echogenicity (black arrow), dilation of portal veins (white arrow), reduced visualization of portal walls and gallbladder wall thickening were noted in this dog (GB: Gall bladder).

**Şekil 1. a:** Köpeğin ventriküler seviyesinden sağ ventrikül dilatasyonu ve paradoksisal septal hareketi gösteren M-mod kaydı. b: Bu köpekte artan ekojenitenin linear bantları (siyah ok), portal ven dilatasyonu (beyaz ok), portal duvarın görünümünün azaldığı ve safra kesesinin duvarının kalınlaştığı kaydedildi.



**Figure 2. a:** Liver extremely enlarged and friable in consistency and it was covered with fibrin tags, b: In the right auricle a grass awn with a black stem and a spike-like head was embedded next to the entrance of the vena cava, c: In the heart muscles numerous ring-shaped foreign bodies, which were considered to be microscopic particles of grass awn, were observed (thin arrow). Muscle fibers were replaced by collagen (thick arrow) (Masson's trichrome, 100x), d: In the heart foci of degenerate neutrophils and foreign-body giant cells (thick arrow) around the microscopical particles of the grass awn (thin arrow) (H&E, 200x), e: In the liver marked destruction in parenchymal cells, and replacement of these cells by erythrocytes within the remaining reticulin framework (H&E, 200x), f: Dilation in portal and lymphatic vessels and increase in perivascular collagen tissue (Masson's trichrome, 100x).

**Şekil 2. a:** Karaciğer belirgin olarak büyümüş ve gevrek kıvamda, üzeri fibrin ağlarıyla kaplı görünümde, b: Sağ aurikulada siyah saplı ve başak benzeri baş kısmı vena kava girişine saplanmış olan pisi pisi otu, c: Kalp kasında pisi pisi otuna ait mikroskopik parçacıklar olduğu düşünülen çok sayıda halka benzeri yabancı cisimler (ince ok). Üreyen kollagen doku arasında kalan yıkılmış kas

lifli parçacıkları (kalın ok), (Masson'un trikromu 100x) d: Kalp kasında pisi pisi otuna ait mikroskopik parçacıkları (kalın ok) çevreleyen yabancı cisim dev hücreleri (ince ok) ve dejeneratif nötrofiller (H&E, 200x), e: Karaciğer parankim hücrelerinde belirgin yıkılma ve yıkılan bu hücrelerin yerinde eritrositlerle dolu sinusoidler (H&E, 200x), f: Portal ve lenfatik damarlarda genişleme ve perivasküler kollajen doku artışı (Masson'un trikromu, 100x).

Cross sections showed there were caverns, abscesses and in these areas there were two foreign bodies of plant origin which were similar to the one observed in the heart.

Samples for histopathology were taken from a wide range of tissue, fixed in 10 % formalin solution, routinely processed and embedded in paraffin blocks. Then the slides were stained with hematoxylin-eosin (H&E) to be interpreted by light microscopy. Furthermore heart, lung and liver sections were stained with Masson's trichrome stain and the kidney with periodic acid schiff.

#### Histopathological Findings

Histologically, the muscle fibers of the heart where the grass awn was embedded, were replaced by collagenous tissue and the presence of collagenous tissue was confirmed with Masson's trichrome stain. In this area numerous ring-shaped foreign bodies were observed which were considered to be microscopic particles of grass awn (Fig.2c). In addition to this the majority of the muscle fibers were necrotic and there were abscesses, consisting of numerous degenerate neutrophils and foreign body giant cells. The ring-shaped foreign bodies were observed in these abscesses (Fig.2d). There was severe cellular and purulent bronchopneumonia in the lungs. Numerous alveolar macrophages and neutrophil leukocytes, as well as depicted epithelial cells and haemorrhage were observed in the bronchial and alveolar lumina in the lungs. Scattered foci of necrosis, clusters of bacteria, diffuse abscess surrounded by a well demarcated zone in the region where the stalk of grass awn was grossly detected was observed. However the particles of grass awn were not detected in the lungs as they were in the heart. Vasculitis and endothelial proliferation were detected in the majority of the capillary walls. Inflammatory thrombosis was evident in a few main arterial blood vessels. Nodular hyalin-like collagenous proliferation (Hyalin arteriosclerosis) was detected in the intima of these vessels. In some areas in the lungs carnification was observed in the alveolar lumina and in the interalveolar tissue.

In the liver prominent sinusoids were dilated, congested and red blood cells infiltrate the space of Disse. Hepatocytes were atrophic and necrosis was observed in zone 3. In some areas hepatocytes were observed to have disappeared completely due to sinusoidal dilation and congestion despite the insensitivity of these changes (Fig. 2e). Parenchymal necrosis and atrophy were observed to be subsided toward the periphery of the portal regions. Dilation of portal veins with accompanying distension of lymphatics and increased collagen tissue around the vessels were observed (Fig.2f). Lymphoid

atrophy and intrafollicular hyalinosis in the white pulp of the spleen and an increased collagen tissue in the red pulp were seen. There was a marked thickening in the glomerular capillary membrane of the kidneys and in the intertubular areas an increase in the mononuclear cells, especially in plasma cells, was observed.

## Discussion

Inhalation of grass awns and other plant materials by dogs is an uncommon situation (4, 5, 6). Hunting dogs may aspirate during physical exertion (6). The sharp, backward pointing barbs on the grass awns encourage unidirectional migration, enabling them to move down a bronchus and penetrate the visceral pleura (5). Secondary pneumothorax develops by the penetration of visceral pleura (5, 13). In our case, the detection of only the stalk of the grass awn in the right lung lobe and in the right auricle gives us the opinion that it has penetrated the visceral pleura by respiration movements and migrated into the heart. We believe that it is almost impossible for such a big part of the plant to migrate into the right auricle of the heart via haematogenous spread. At necropsy the absence of thrombosis and arteritis in the great vessels supports our hypothesis. The migration of the grass awn over the diaphragmatic crura into the retroperitoneal space causes granulomas, vertebral periostitis or osteomyelitis (4, 5, 6). These results also show that the grass awn can also migrate to the heart.

The pathologic alterations such as congestive heart failure, cardiac insufficiency, pericardial disorders, intracardiac tumours, congenital cardiac defects (cor triatriatum dexter) slows down the hepatic venous flow leading to an increase in postsinusoidal pressure and thus hepatomegaly and ascites develops (3, 7, 10). In the present study, hepatomegaly and ascites have developed due to increased postsinusoidal portal hypertension, which was the result of the obstructive effect of an intracardiacally located foreign body. The relevant changes may develop also due to thrombosis in vena cava caudalis, idiopathic fibrosis, foreign bodies, extra and intraluminal tumours and tumoural metastasis in vena caudalis (11, 14). This histologic view, which has resulted from both cardiac and venous (vena cava caudalis) disorders is referred to as Budd-Chiari or Budd-Chiari-like syndrome in human and veterinary medicine (3, 4, 7, 10). Budd-Chiari-like syndrome is associated with a triad of clinical signs: hepatomegaly, ascites, and abdominal pain (3). The above mentioned presenting signs were also seen in the present case. The clinical symptoms and severe centrilobular sinusoidal dilation detected in the liver, necrosis and atrophy of hepatocytes, which led to a congested appearance in the sinusoids are all consistent with the clinical findings, indicated for Budd-Chiari-like syndrome. For this reason, we consider that, just like the intracardiac tumors and intracardiac defects (cor triatriatum dexter) that are reported in the right

heart, symptoms similar to Budd-Chiari-like syndrome can develop due to the foreign body (grass awn) that is detected in the right auricle.

In dogs with obstruction of hepatic venous outflow, ascites develop subsequent to high postsinusoidal pressure, which increases production of hepatic lymph. The capillaries of the hepatic sinusoids have larger fenestrations than do the peripheral capillaries and are, therefore, more permeable. Increased postsinusoidal pressure causes leakage of protein and fluid from hepatic sinusoids into the interstitial space (space of Disse) (3). When the capacity for lymph drainage by way of the thoracic duct is exceeded, hepatic lymph accumulates in the peritoneal cavity as high-protein ascites, characterized as a modified transudate with greater than 2.5 g/dl of protein (4). Also the abdominal fluid of this dog is characterized as a modified transudate with 2.8 g/dl of protein and that's why it's compatible with the ascites fluid that is formed due to the chronic postsinusoidal venous obstruction.

In our case we considered that the hypoproteinaemia has developed due to the hypoalbuminaemia which occurred secondary to the lesions in the liver and we also believe that membranous glomerulonephritis plays a role in the formation of hypoproteinaemia. We also considered that jaundice is related with the diffuse atrophy and necrosis of the liver parenchyma of the which causes a deficiency in the metabolism of bilirubin and thus hepatic jaundice. In the Budd-Chiari-like syndrome splenomegaly is observed with hepatomegaly which develops due to the increased postsinusoidal hypertension (11). In the present study the detection of splenomegaly in the dog makes us believe that it develops due to the postsinusoidal hypertension.

As it is reported in the literature (5, 6) the dog in our case is a hunting dog. Also the geographical features of the area is important in the aetiology of grass awn disease. Koutinas et al. (8) reported that grass awn (*Hordeum spp*) was commonly detected in hunting dogs in Greece and the low humidity and hot, dry long summers played an important role in aetiology. Turkey is a Mediterranean country like Greece and has a similar climate. Therefore the cases of grass awn disease in dogs are frequently reported in our country but the most commonly affected sites are external ear canal and interdigital skin (16). In our country bronchiectasis of cases which developed due to the aspiration of grass awn (grass inflorescence) were reported also in the children (1).

In conclusion, we suggest that, rarely grass awns can migrate into the heart and therefore in the regions where the summers are long and dry, for dogs and cats showing similar symptoms grass awn disease may be considered as a differential diagnosis.

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