

Surgical Treatment in Canine Dirofilariosis by Pulmonary Arteriotomy A Case Report

(Kanin Dirofilariosis'inin Pulmoner Arteriotomi
İle Cerrahi Sağaltımı - Olgu Sunumu)

SARITAŞ, Z.K.¹, ÖCAL, N.², APAYDIN, N.³,
PAMUK, K.¹, ŞAHAL, M.⁴, GÖKÇE, A.P.⁵,
KATIRCIOĞLU, S.F.⁶

¹ Department of Surgery, Faculty of Veterinary Medicine,
University of Afyonkarahisar Kocatepe. Afyonkarahisar-
TURKEY

² Department of Internal Medicine, Faculty of Veterinary
Medicine, University of Kırıkkale. Kırıkkale-TURKEY

³ Department of Surgery, Faculty of Veterinary Medicine,
University of Erziyes. Kayseri-TURKEY.

⁴ Departmet of Internal Medicine, Faculty of Veterinary
Medicine, University of Ankara. Ankara-TURKEY

⁵ Department of Surgery, Faculty of Veterinary Medicine,
University of Ankara. Ankara-TURKEY

⁶ Cardiovascular Surgery Clinic, Türkiye Yüksek İhtisas
Hospital. Ankara-TURKEY

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SUMMARY

Dirofilaria immitis is a nematode prevalent in dogs and can be diagnosed by detecting microfilaria in blood smear samples with a light microscope. The present case is a 35 kg male Anatolian shepherd breed dog which was brought to our clinic with the complaints of weight loss and cough. In preoperative biochemical and urine analyses, no evidence of an organ deficiency was observed. Leucocytosis was present in hematological examination. Surgical intervention was used to remove the adult parasites. During the surgery, ECG and arterial blood pressure through a femoral arterial catheter was monitored. Under general anesthesia left thoracotomy was performed through the 4th intercostal space. Pulmonary artery was dissected. A 2 cm longitudinal incision was made to the pulmonary artery and then an arterial graft was inserted into the pulmonary artery through this incision site. The mean arterial blood pressure was intentionally dropped down to 60 mmHg. Using a long Alligator forceps, blind shots were performed through the graft for a period of 10 minutes to

clasp and remove parasites. Eight adult parasites located in the pulmonary artery were removed. Using an inotropic drug, blood pressure was elevated up to its normal limits. No complications appeared during the postoperative period. Ivermectin (50 mcg/kg) was administered subcutaneously after surgery. During the six month post-surgery, no microfilaria was encountered in the peripheral blood.

Key Words: Dog, *Dirofilaria immitis*, Pulmonary Arteriotomy, Thoracotomy.

ÖZET

Dirofilaria immitis köpeklerde gözlenen bir nematod olup, periferik kandan alınan örneklerin ışık mikroskobunda incelenmesiyle mikrofilere gözlenmesiyle tanısı konabilir. Sunulan bu olgu 35 kg ağırlığında erkek kangal köpeğiydi ve kliniğe kilo kaybı ve öksürük şikayetiyle getirildi. Preoperatif biyokimyasal ve idrar analizlerinde organ yetmezliğine ilgili bir bulguya rastlanmadı. Hematolojik muayenede lökositozis belirlendi. Olgun parazitlerin uzaklaştırılması için cerrahi girişim uygulandı. Cerrahi uygulaması sırasında EKG ve arteriyel kan basıncı monitörizasyonu femoral arter kateteri aracılığıyla gerçekleştirildi. Genel anestezi altında 4. interkostal aralıktan sol torakotomi gerçekleştirildi. Arteria pulmonaris diseke edildi. Satinsky damar pensiyiyle tutulan a.pulmonaris'e iki cm uzunluğunda longitudinal ensizyonu gerçekleştirildi. Damar grefti ensizyon hattına dikildi. Ortalama arteriyel kan basıncı 60 mm Hg'ya düşürüldü. Uzun Alligator forsepsi kullanılarak 10 dakika boyunca greft içinden kör atışlar yapıldı ve olgun parazitler uzaklaştırıldı. Arteria pulmonaris'e lokalize olan 8 olgun parazit uzaklaştırıldı. İnotropik ilaç kullanılarak arteriyel kan basıncı normal seviyeye çıkarıldı. Postoperatif periyotta komplikasyon gözlenmedi. Postoperatif periyotta ivermektin (50 mcg/kg) derialtı yolla uygulandı. Altı aylık postoperatif gözlem periyodunda periferik kanda mikrofilere rastlanmadı.

Anahtar Kelimeler: Köpek, *Dirofilaria immitis*, Pulmoner Arteriotomi, Torakotomi.

INTRODUCTION

Dirofilaria immitis is a nematode that is highly prevalent in dogs and causes a parasitic infestation called dirofilariosis, also known as heartworm disease. *D. immitis* is also seen in other species including cats, foxes, bears, wolves, horses and rarely human (3, 13, 16). The mature parasites are localized in the right ventricle and in the pulmonary artery (3, 13, 16). The female parasite lays a few thousands of microfilaria into circulating blood per day (2, 13, 16). Microfilariae are transmitted among animals by mosquitoes (3, 13, 16). The microfilariae complete their maturation process as they arrive the right ventricle (16).

The risk of infection is higher in dogs aged 4-7 years. Males carry a higher risk of infection than females due to more outdoor exposure (6, 15). The mongrel dogs, especially those of large breeds, are more susceptible to dirofilariosis (16).

The dogs infected with *D.immitis* sometimes do not exhibit any clinical signs of dirofilariosis. The initial clinical signs include exercise intolerance and weight loss. Cough, dyspnea, and chest pain are usually observed. Pulmonary hypertension is usually associated with canine dirofilariosis that eventually leads to pulmonary edema, impairment in the right heart chamber functions and ascites. All of these complications worsen the clinical condition of infected dogs (11, 16).

The surgical treatment in dirofilariosis is performed to remove the mature parasites from the right ventricle or pulmonary artery where they are localized. For this purpose, the jugular venotomy (4, 10), pulmonary arteriotomy (1, 4, 8), direct ventriculotomy (4), inflow occlusion and right ventriculotomy (4) as well as open heart surgery with the support of extracorporeal circulation (7, 13) were applied.

Surgical trauma induced by the thoracotomy method is a serious source of stress that may eventually result in death (9).

The goal of performing pulmonary arteriotomy is the removal of the adult parasites. For this purpose, inflow occlusion is performed (1, 7). Another technique is removing the parasites from the pulmonary artery using a flexible alligator forceps. However, manipulations in the latter technique may harm the pulmonary artery (14). In the present case, a new approach of pulmonary arteriotomy using a temporary graft is described.

CASE PRESENTATION

A 35 kg male, seven years old Anatolian shepherd breed dog was brought to the Clinics of the Department of Internal Medicine, Ankara University with complaints of weight loss and cough.

Clinical Findings: In clinical examination, intolerance to exercise was determined. Ascites was not detected. Murmur was detected in cardiac auscultation. In blood smear, microfilariae was present in substantial quantities.

Laboratory Findings: Venous blood samples were used in routine biochemical and hematological examinations. No findings of any organ dysfunction or impairment were determined. Leucocytosis was detected in hematological examination (Table 1). In analyses of blood gases, pH was 7.30, PCO₂ was 45 mm Hg, % O₂ was 68 and BE: -6,9 mmol/L

Table 1. Hematological Finding of the Dog with Canine Dirofilariosis

Parameters	Reference Values	Obtained Values
RBC (10 ⁶ /mm ³)	5,5 - 8,5	5,72
MCV (m)	60 - 77	66,1
HTC (%)	37 - 55	44
WBC (10 ³ /mm ³)	6 - 17	19,54
Hb (g/dl)	12 - 18	12,43

Surgery

Anesthesia protocol

Once the case was decided for a surgical treatment, the dog had not been allowed to access food for 24 hours prior to surgery. For pre-medication, atropine sulfate (0.04 mg/kg) was administered subcutaneously which was followed by an intra muscular injection of Xylazin HCL (2 mg/kg). An 18 gauge catheter was placed in the antebrachial cephalic vein for subsequent drug and fluid administrations. Ringer lactate solution was infused throughout the entire period of operation.

General anesthesia was induced by intravenous administrations of 2.5% Thiopental sodium solution (15 mg/kg) and Fentanyl Citrate (5 mcg/kg). The dog was intubated and connected to an anesthesia machine. The maintenance of anesthesia was achieved by isoflurane administration. The femoral region was aseptically prepared and the cavafix catheter was placed into the femoral artery. As the catheter was connected to the pressure transducer, arterial pressure was continuously monitored on the computer screen during the whole period of operation. Via ECG leads attached to extremities, ECG was continuously monitored on a multi-channel screen (13).

Surgical protocol

While the dog was on the right lateral recumbency, the left thoracic region was clipped and prepared for an aseptic surgery. 100 U/kg of heparin administered intravenously. In aseptic condition, an intercostal thoracotomy was performed through the 4th intercostal space. Upon reaching the thoracic cavity, the ribs were separated using a thorax retractor. In order to minimize bleeding, the mean arterial pressure was intentionally dropped down to 60 mmHg levels. There after, a temporary graft was implanted on the pulmonary artery in order not only to control bleeding but also to ease the manipulation within the artery. The pulmonary artery was dissected for this purpose and Satinsky vascular forceps was placed to provide a half occlusion and then a 2 cm long longitudinal incision was made, followed by an artificial anastomosis of a 15 cm long and 2 cm wide vascular graft (Figure 1). Upon placing purse-string sutures at the free end of the graft, Satinsky vascular forceps was removed from the pulmonary artery. Through the vascular graft a long alligator forceps was inserted and the then blind shots were made to grasp the adult parasite with the forceps. Via this manipulation for 10 min, 8 mature parasites were removed (Figure 2). Inotrop support was provided until arterial blood pressure was elevated up to its normal levels. The vascular graft implanted on the pulmonary artery was removed and then the vessel was closed with continuous sutures, using 6/0 propylene suturing material. Blood accumulated within the thoracic cavity was removed to a reservoir using a pump before the thoracic cavity was closed and infused through the venous system of the dog. Upon blood gases and blood pressure reached to a relatively stable level, the thoracic wall was closed using an appropriate technique. To drain the thorax, an underwater drainage system was employed and the dog was

ventilated with positive pressure using a mixture of oxygen and air (50-100%) to enhance drainage.

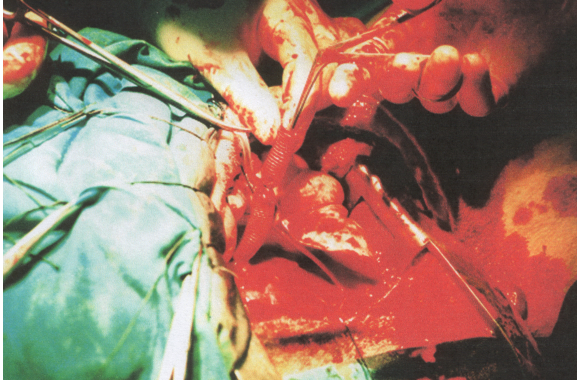


Figure 1. Pulmonary Artery Graft



Figure 2. Adult *D.immitis* Removed from Pulmonary Artery

Postoperative Care:

During the postoperative period, ventilation with positive pressure continued throughout the intensive care procedure until the drain was removed. For analgesia and sedation, a combination of Meperidine hydrochloride (25-50 mg iv) and Morphine sulfate (10 mg iv) was administered. The dog was kept in an intensive care unite until the certain degree of stability for critical parameters was obtained. The dog was entubated for 12 hours after the surgery. The sutures on the skin were removed on the 9th day of post-operation.

On the 3rd day and 1st month of post-operation, ivermectin (50 mcg/kg sc) was administered. On routine monthly clinical check-ups and peripheral blood examinations, neither clinical signs of the disease nor microfilariae in the blood were observed. The case was followed for 6 months.

DISCUSSION and CONCLUSION

Dogs infected with *D.immitis* may not exhibit any clinical sign of dirofilariasis. The initial clinical signs of the disease are exercise intolerance and weight loss.

Cough, dyspnea, and chest pain are usually associated with the disease (13, 16). These results are in accordance with the literature.

As pulmonary edema, right heart impairment, and ascites develop in canine dirofilariasis, the clinical prognosis worsens gradually (16). In the present case, ascites was not present. No dilatation was detected in the right heart chambers during the radiological examination. However, respiration was severely depressed.

In dogs with dirofilariasis, pulmonary hypertension usually develops which eventually induces further clinical signs. Presence of live parasites in large quantities interferes with the blood flow in the pulmonary artery which, consequently, increases the arterial blood pressure (11, 16). The present case was associated with high blood pressure which, however, did not reach to a level to induce hypertension. It is thought that absence of hypertension is most likely related to the absence of occlusions in the pulmonary artery.

The venous blood gas PO₂ is about 40.0 mmHg in dogs with severe dirofilariasis, while it is 55.3 mmHg in healthy individuals (12). In preoperative evaluation of the present case, pH was at the lowest limit as PCO₂ was elevated. Furthermore, PO₂ and HCO₃ were lower. The values recorded in the present case are overall comparable to the report by Kitagawa et al. (12). The presence of intolerance to exercise observed in the present case could also be a clinical outcome resulted from changes in parameters above.

The medical intervention employing adulticidal drugs is associated with the risk of unwanted events including pulmonary embolism and occlusion (3,16). Thus, surgical intervention is a strong alternative to remove mature parasite (5). Recent literature presents several techniques for the removal of mature parasites from the caudal vena cava through vena jugularis, cardiopulmonary bypass (CPB) (13), ventriculotomy and pulmonary arteriotomy (1, 13).

The most radical choice of surgical intervention is CPB. However, this is an expensive technique and requires surgery team with high experience. Thus, the pulmonary arteriotomy, a relatively inexpensive and practical technique, was the choice of surgery in the present case. It is known that approximately 90% of mature parasites can be removed from the ventricle and pulmonary artery (4). In the present case, 8 mature parasites were removed.

To prevent excessive bleeding in arteriotomy, inflow occlusion is applied. If this method used in a surgical protocol involved in a heart manipulation, sternotomy is performed to be able to reach the heart (1,4). In the present case, arterial blood pressure was dropped temporarily down to 60 mm Hg and a graft was also implanted onto the pulmonary artery to minimize blood loss. The inflow occlusion was not employed in the present case as the lateral throcatomy, a relatively easier and less painful method, was performed to expose the thoracic cavity.

As also performed in the present case, the pulmonary arteriotomy differs from the other surgical methods by a temporary drop of the arterial blood pressure down to the

levels of 60 mm Hg. Application of the graft to the pulmonary artery in the present study provided further control over excessive bleeding. Furthermore, the graft provided a ground so that parasites to be removed were relatively easier to reach.

It is decided that the surgical method of pulmonary arteriotomy to remove mature parasite carries a lower risk of damage to vital body functions and of serious complications. Mature parasites both in the right ventricle and the pulmonary artery can be easily removed under a state of controlled hypotension and subsequently lower the risk of excessive bleeding. In the present case, blood accumulated in the thorax was drained to a sterile blood reservoir and then infused back to the venous system that helped minimize the blood volume loss.

As a result, pulmonary arteriotomy with application of a temporary graft to the pulmonary artery is a useful surgical technique to remove mature *D.immitis* from the right ventricle and the pulmonary artery.

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ARAŞTIRMA ÖZETİ

Köpeklerde Lipomaların Ultrasonografik Özellikleri

“Ultrasonographic features of canine lipomas”

ANTONELLA VOLTA, MATTIA BONAZZI,
GIACOMO GNUDI, MARGHERITA GAZZOLA,
GIORGIO BERTONI

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Bu çalışmada köpeklerdeki lipomaların ultrasonografik özelliklerinin değerlendirilmesi amaçlanmıştır. Yumuşak doku kitlesine sahip 94 köpeklik bir grup değerlendirildi. Tüm köpekler ultrasonografik ve sitolojik veya histolojik olarak muayene edildi. Bu kitlelere sahip köpekler içerisinde lipoma tanısı konulan 24 köpek seçildi. Yirmi dört köpekte 55 lipoma mevcuttu. Elli bir lipoma yüzelekti ve deri altında lokalize olmuştu. Dört lipoma ise derindeydi ve paratestiküler bölgede lokalizeydi. Ultrasonografik olarak lipomalar oval, iyi tanımlanabilir, kapsülülü ve çizgili bir yapı şeklinde görüldü.