

SURGICAL EXTRACTION OF ADULT FORMS OF DIROFILARIA IMMITIS IN DOG. A PILOT STUDY

**Nadya Zlateva-Panayotova¹, Georgi Marinov¹, Radoslav Rafailov¹, Boris Borisov²,
Dimitar Hadzhimitev², Panayot Panayotov², Evdoxia Magkrioti², Bogdan Aminkov¹**

¹University of Forestry, Faculty of Veterinary Medicine, Sofia, Bulgaria

²St. George Veterinary Clinic, Sofia, Bulgaria

E-mail: nzlateva@ltu.bg

ABSTRACT

In recent years, recorded cases of dirofilariasis in dogs have increased significantly in our country. The IDEXX 4Dx Snap test was positive for dirofilariasis. The operation was performed in a dog, male, mixed breed, 8 years of age, neutered. The worsened general condition of the animal, impaired cardiac activity, and elevated liver transaminases were a prerequisite for choosing the operative treatment of the animal. After access through v. jugularis from the heart were removed 9 adult forms of *Dirofilaria immitis* (5 females and 4 males). The postoperative period was without complications.

Key words: surgical extraction, dirofilaria immitis, heartworm, dog.

Introduction

The number of diagnosed cases of dirofilariasis in Bulgaria has increased significantly in recent years. Adult forms of the parasites localize in the right atrium, causing severe organic changes in the heart muscle and leading to decompensated heart failure. Surgical extraction is the only option for removing adult parasites, especially in dogs with a kaval syndrome (Borgarelli M et al. 1997; Bove C. et al. 2010). Operative methods involving the extraction of the heartworms by thoracotomy and their removal through the right atrium or pulmonary vessels are associated with high mortality due to the severity of surgical intervention, advanced disease stage, allergic, immunomodulatory reactions, pneumonia, etc. (Glaus T. et al., 1995; Kuntz C. et al. 1996; Borgarelli M. et al. 1997)

Surgical methods involving extraction of the parasites through v. jugularis using catheters (eg, tripod forceps, basket device or loop snare device) are significantly safer for the patient. The main advantages of the methods are minimal invasiveness of the procedure and damage to the vascular system, as well as short-term period of the procedure itself (Bove C. et al. 2010). Using a guiding catheter with a trap basket minimally damages the vessel wall, but its effectiveness is low because the worms are trapped blindly (Yoon W et al., 2011). Using a forceps damages the vessel wall and has again a low effectiveness rate (Lee S. et al., 2008).

The purpose of this pilot study was to evaluate the effectiveness and invasiveness of the use of a catheter with gripping edges in surgical extraction of adult forms of dirofilaria using an access through v. jugularis.

Material and methods

It is about a castrated male dog, mixed breed, 8 years of age, weighing 22 kg. According the anamnesis the dog has not been dewormed during the last year. Over the past month, owners have found decreased physical activity, lethargy, apathy, cough and unnatural posture. Diagnosis of dirofilariasis was performed by a rapid ELISA test (IDEXX SNAP 4Dx Plus®). To prove the presence or absence of microfilariae, we used the modified Knott method.

A detailed clinical examination, morphological and biochemical blood test, X-ray and echocardiographic examination of the thoracic cavity, abdominal ultrasonography were performed preoperatively.

Anesthetic protocol

Premedication - Atropine HCl, 0.02 mg/kg SC, 15 min before induction of anesthesia. We placed an intravenous catheter, 20 g, maintained with NaCl 0.9%, 20 ml/kg/h. The induction was made with Propofol (Diprivan®) at a dose of 5 mg/kg IV, maintenance - with Isoflurane (Forane®) 2.5 vol% and oxygen 2.5 l/min.

Surgical protocol

The patient was placed in lateral recumbence, lying on its left side and after routine aseptic preparation, we made an approach to v. jugularis with a length of about 5 cm, sequentially cutting the skin and bluntly separating mm brachicephalicus and sternocephalicus. At the cranial aspect of the vein incision, was placed a clamp. A linear incision was applied to the vessel with a length of about 2 cm, through which we inserted the pre-prepared catheter. After inserting it to the level of the heart, we rotated the catheter several times in the clockwise direction and smoothly pulled it off. We repeated the procedure several times, and in the first extraction we extracted 6 pieces, in the second – 3 pieces of adult nematodes. Regardless of the ability to ligate v. jugularis, we have restored its integrity by suturing with a synthetic polyfilament absorbable suture material (Polyglycolic acid, 4-0). The remaining tissues we sutured routinely. Postoperative therapy included antibiotics, corticosteroids, hepatoprotectors and pain killers.

Results

The clinical examination revealed: IBT was 39.0 °, cyanotic conjunctivas, prolonged capillary refill time. The animal's posture has been changed - with laterally expressed forelimbs, with enlarged and baggy belly filled with liquid. In auscultation, the heart tones were blunted, and pathological noises and stridors were heard. The paraclinical study showed leukocytosis ($19.1 \times 10^9 / L$), increased liver transaminase activity (ASAT 327.0 U/L, ALAT 145 U/L, AF 874 U/L). The IDEXX SNAP 4Dx Plus® test was positive for dirofilariasis.

The blood test using the modified Knott method showed presence of microfilariae. Using magnification SP 4 (0.10 160) 0.17 in each field of view was observed between 2-3 microfilariae, which determines the microfiliariemia as strong. The species characteristics of the larvae were made according to the length, width, front and back end of the microfilariae, with all measured larvae being between 290 and 330 µm with a sharp-edged head and a conical tail (Kanchev K. et al., 2016) which fully coincide with the characteristic of the larvae first stage of the parasite *Dirofilaria immitis* (Fig. 1).

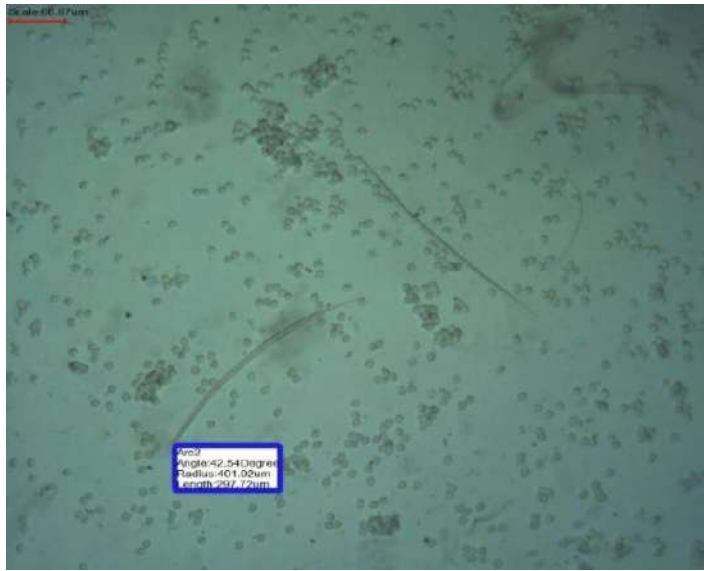


Figure 1: Microfilariae in the background of hemolyzed red blood cells

The x-ray examination of the chest in lateral and ventro-dorsal projection showed increased lung radiopacity, increased size of the pulmonary blood vessels, and right-sided cardiomegaly. Several strong metal shadows were also identified, probably by projectiles, which, according to anamnestic data, are from more than four years ago. Observed clinical signs and radiographic findings are characteristic manifestations of Kaval syndrome (Fig. 2, 3).



Figure 2: Lateral radiography of the thorax

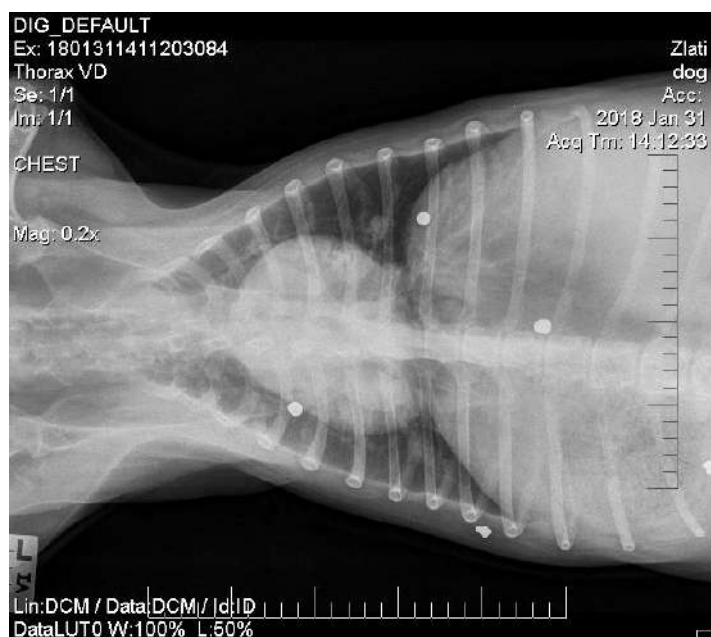


Figure 3: VD-radiography of the thorax



Figure 4: Echocardiography with hyperechoic shadows in the right atrium

In the ultrasound examination, free fluid was found in the abdominal cavity, hepatomegaly with enlarged liver vessels and hyperechoic shadows in the parenchyma, splenomegaly without pathological changes in the parenchyma. Cardiac echocardiography showed 4 linear hyperechoic shadows in the right atrium, susceptible to heartworms (Fig. 4).

Based on the results of the serological test, the clinical and paraclinical data, the results of the ultrasonographic and radiographic examination, we decided to perform a surgical intervention to remove adult parasites from the heart as the only option to stabilize the patient.

We prepared a sterile catheter with a lumen diameter of 3 mm, at the end of which we placed three surgical sutures (PGA, polyfilament, 1) with free ends. The purpose of this catheter is to function as a brush around which the nematodes should be caught (Fig. 5).

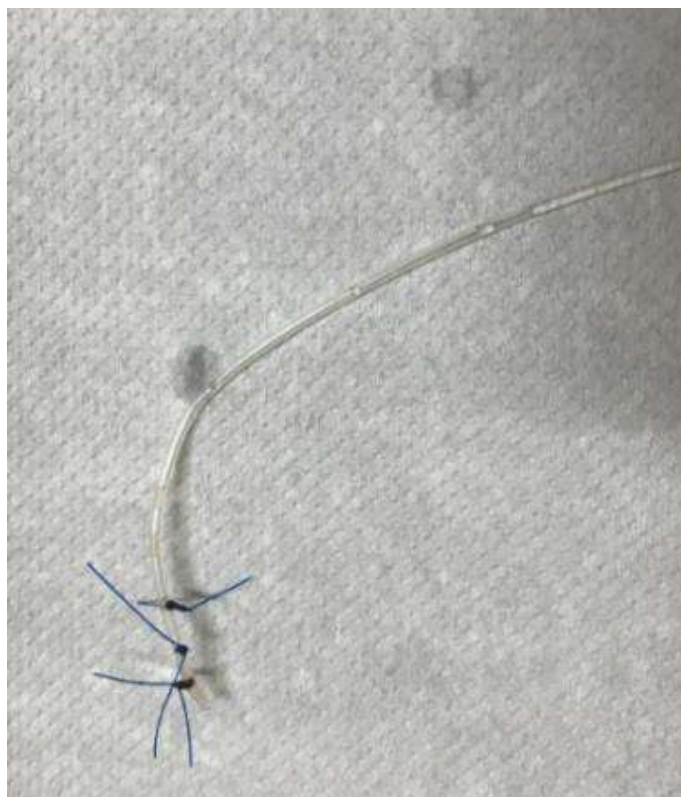


Figure 5: A catheter for microfilariae withdrawal

The patient was stabilized preoperatively via intravenous infusions of NaCl 0.9%, Glucosae 5%, and treated with ACE inhibitors, diuretics and hepatoprotectors. During the abdominocentesis were evacuated 750 ml of serous-hemorrhagic exudate.

Characterization of extracted adult forms of parasites

Adult forms are localized in the pulmonary arteries, the right ventricle, the right atrium, and the v. cava cranialis. Atypically they can meet in different body cavities, eyes and brain. During the surgical intervention we managed to remove nine adult microfilariae (Fig. 6).

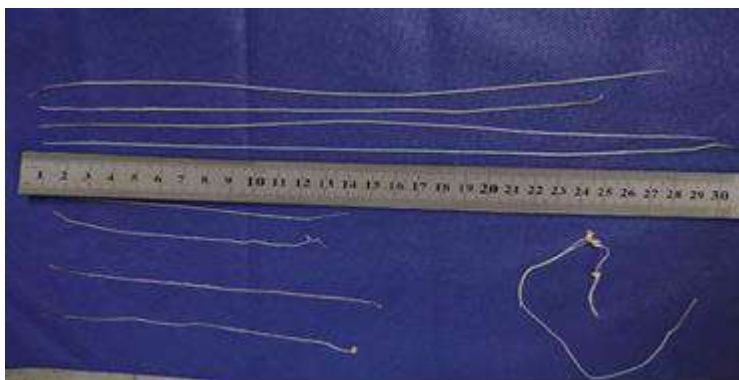


Figure 6: Nine adult forms of *Dirofilaria immitis*

Based on their morphology, five of them were defined as female (Fig. 7) having a thin, long, whitish body, ending with a straight posterior edge and sizes between 28 and 32 cm.

The posterior end of the other four was spirally curved, measuring between 15 and 17 cm, based on which they are characterized as male (Fig. 8).



Figure 7: Female adult nematode of *Dirofilaria immitis*

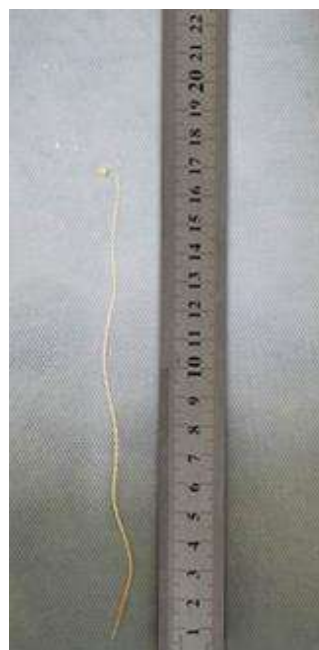


Figure 8: Male specimen of *Dirofilaria immitis*

Discussion

Dirofilariasis in dogs is a potentially life-threatening disease, and infection occurs in the environment by mosquitoes that are carriers of the invasion. Initially, the disease is asymptomatic.

The manifestation of clear clinical signs only occurs in the second-third stage when adult forms of *Dirofilaria immitis* can be found in the pulmonary arteries, right atrium and right ventricle.

In the advanced form of the disease (Caval syndrome), surgical removal is the only possible treatment approach, as the extraction of adult forms would allow the use of specific drugs for therapy without the risk of thromboembolism (Glaus T. et al., 1995). The main goal is the procedure to be minimally invasive, with short-term anesthesia and rapid recovery of the patient due to worsened respiratory, cardiac, hematological, etc. indicators (Bove C. et al., 2010). The use of a brush-shaped plastic catheter to extract adult forms of *Dirofilaria immitis* is minimally invasive, with a low level of intraoperative pain and short operative protocol, which is a prerequisite for high success rate and rapid recovery of the patient. This allows the surgery to be performed under a relatively mild plan of general anesthesia.

Due to the complexity and risk of surgical extraction, the greatest importance is given to the prevention of dirofilariasis with reliable anti-external parasite agents and the conduct of periodic rapid tests to diagnose the disease before its clinical appearance.

Conclusion

The use of a brush-shaped plastic catheter of predetermined length according to the patient is a suitable method for extracting adult forms of *Dirofilaria immitis*.

The procedure is low invasive with a low level of pain, allowing it to be performed under a mild plan of general anesthesia.

In animals with advanced stage of the disease, this is the only treatment approach, as the extraction of adult forms will allow the use of specific drugs for treatment.

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