

Surgical correction and outcomes of persistent right aortic arch in two dogs

Case Report

Volume: 4, Issue: 2
August 2020
Pages: 51-56

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ABSTRACT

The case report was consisted of two puppies with the complaint of chronic vomiting after feeding. The dogs were vomiting after eating and their abdominal areas were tense. Also, growth retardation was present. Accumulation of the contrast material was seen at the thoracic part of the esophagus with indirect radiographs in both cases. The cranial and caudal widths of the stricture in the esophagus were measured before and after surgery. The cranial and caudal parts of the stricture were found both dilated. The ligament that causing stricture was dissected by surgery and the stricture area was enlarged by balloon esophagoplasty. Case 1 was died on 2nd hour postoperatively, while Case 2 fully recovered and healed. In Case 2, the diameter of the prestenotic and poststenotic esophagus found decreased at 16th month postoperatively. The long-term results of Case 2 were fairly well.

Keywords: persistent right aortic arch, vascular ring anomaly, dog

Article History

Received: 20.07.2020
Accepted: 12.08.2020
Available online:
18.08.2020

DOI: <https://doi.org/10.30704/http-www-jivs-net.772064>

To cite this article: Yurtal, Z., İşler, C.T., Deveci, M.Z.Y., Altuğ, M.E., Kırız, Ö. (2020). Surgical correction and outcomes of persistent right aortic arch in two dogs. *Journal of Istanbul Veterinary Sciences*. 4(2), 51-56, **Abbreviated Title:** *J Ist Vet Sci*

Introduction

Vascular ring anomalies (VRA) occur as a result of abnormal development of embryonic aortic arches. It is a congenital disease caused by the trachea and esophagus being surrounded by blood vessels and adjacent structures (House et al., 2005; Fossum, 2013). The large vessels from the heart that developed abnormally, result in the compression of the esophagus and rarely the trachea (Yalçın et al., 2009). The cause is not fully known in animals. However, maternal infections,

vitamin A deficiency, genetic or teratogenic factors are thought to play a role in the pathogenesis (Karabagli and Bahadir, 2017). The most common type of VRA is the permanent right aortic arch (PRAA), also known as the fourth permanent right aortic arch (Loughin and Marino, 2008, Yalcin et al., 2009). The permanent right aortic arch, accounts for 95% of all VRAs diagnosed in dogs (Buchanan, 2004). Although it can be seen in all breeds, it is mostly seen in German shepherd and

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Irish setter dogs, and in Persian and Siamese cats. There is no gender predisposition. Neutering of the affected animals is recommended. Vascular ring anomaly is usually diagnosed before 6 months old. It is rarely diagnosed in adults (Karabagli and Bahadir, 2017). Clinical symptoms usually start in the 2nd-6th months with vomiting at the changeover to solid feeding (Muldoon et al., 1997; Menzel and Distl, 2011). The diagnosis is provided by clinical and radiographic findings. Although medical treatment does not result satisfactory, it may be useful to prevent secondary diseases caused by VRA (Karabagli and Bahadir, 2017). The definitive treatment of VRA in animals, is to ligate and cut off the vascular ring causing constriction (Helphrey, 1979). Surgery should be performed at the earliest stage to prevent irreversible disruptions.

Cases

The aim was to share the clinical presentation, diagnosis and results of surgical treatment of vascular ring anomalies in two dogs. In case 1, a 1.5 months old male Chow Chow puppy was presenting with the vomiting immediately after feeding for 15 days. Clinical examination revealed a rubbing sound from lungs, abdomen was swollen and tympanic, but general findings such as body temperature and pulse were normal. In radiographic examination, direct radiographs (Laterolateral and ventrodorsal) were taken first. The stomach was filled with gas and then indirect radiography was taken. Barium sulfate was observed to accumulate in the front of the stricture in the esophagus and esophageal dilatation (ED) was measured on radiography

(Figure 1a). Vascular ring anomaly was diagnosed and the surgery planned.

In case 2, the patient was a male, 2 months old Malinois-Siberian husky crossbreed puppy. The patient had been vomiting undigested content immediately after eating and or drinking for 20 days. Direct radiographs (laterolateral and ventrodorsal) were taken first. Indirect radiography taken with barium sulfate revealed a stricture in the esophagus and an excess filling in the anterior aspect of the stricture (Figure 1 b). The diagnosis was vascular ring anomaly, which was typical in appearance. Surgical operation was considered appropriate and planned.

On the indirect radiographic images taken laterolateral position (LL), there was esophageal dilatation in the cranial of the structured area in both cases. The esophageal dilation measurements of two cases are reported in Tables 1 and 2. The result in case 1 was prestenotic ED, 2.931, and considered as moderate esophageal dilation (Table 1). Poststenotic esophageal dilation was 4.424 and considered advanced esophageal dilation (Table 2). Pre and post-stenotic areas are shown in the preoperative radiograph of Case 1 in Figure 1 a. In case 2, the degree of prestenotic dilation was measured as 5.761 and it was observed that there was an advanced degree of esophagus dilation (Table 1). Poststenotic esophageal dilatation was 2.315 and considered as moderate esophageal dilation (Table 2). Pre and post-stenotic areas are shown in the preoperative radiograph of Case 2 in Figure 1b. On the contrast radiograph taken 16th month postoperatively,

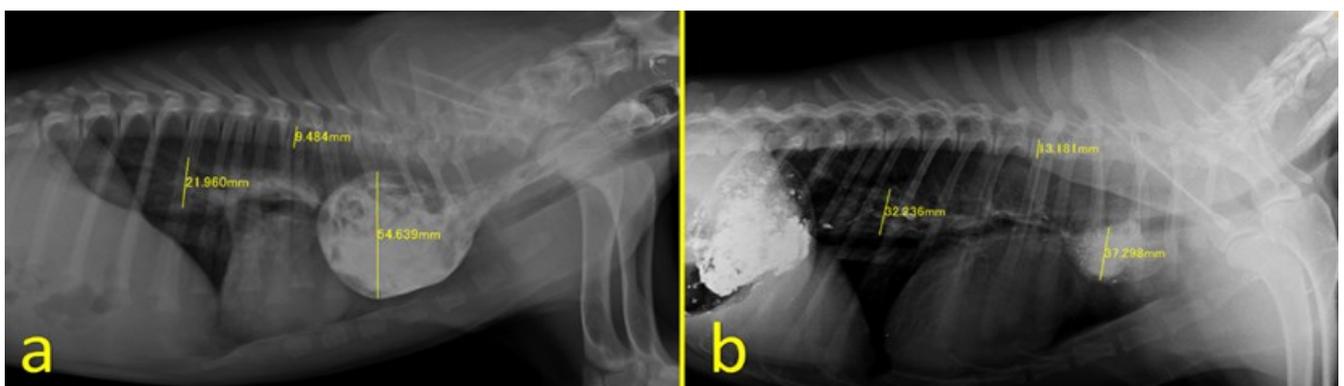


Figure 1. Preoperative and poststenotic radiographic images of case 1 (a) and case 2 (b)

Table 1. Prestenotic dilatation degrees of case 1 and case 2 before the surgery

Case	T5- height (mm)	Esophageal dilation (ED) (mm)	Dilation value (Dilatation / T5)	Dilation degree
Case-1	5.869	17.205	2.931	Moderate
Case-2	9.484	54.639	5.761	Severe

Table 2. Poststenotic dilatation degrees of case 1 and case 2 before the surgery

Case	T5- height (mm)	Esophageal dilation (ED) (mm)	Dilation value (Dilatation / T5)	Dilation degree
Case-1	5.869	24.791	4.224	Sever
Case-2	9.484	21.960	2.315	Moderate

Table 3. Postoperative (16th month) prestenotic and poststenotic dilatation degrees of case 2

Case	T5- height (mm)	Esophageal dilation (ED) (mm)	Dilation value (Dilatation / T5)	Dilation degree
Prestenotic	13.181	37.298	2.829	Moderate
Poststenotic	13.181	28.594	2.169	Moderate

pre-stenotic esophageal dilatation was 2.829 mm, post-stenotic esophageal dilatation was 2.169 mm. Therefore, esophageal dilatation found to be regressed (Table 3). The postoperative 16th month prestenotic and poststenotic radiography image is given in Figure 2.

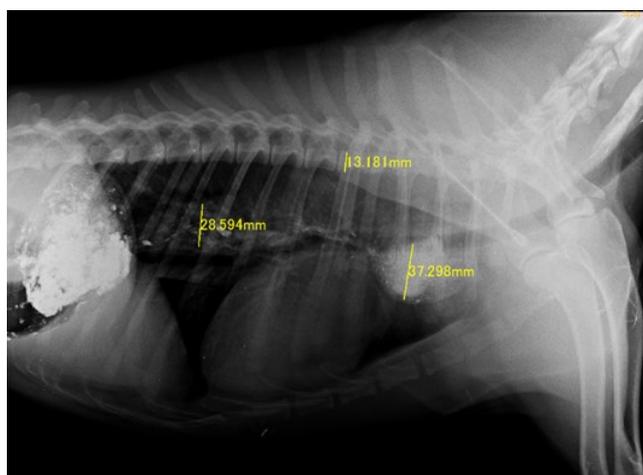


Figure 2: Poststenotic radiographic image of Case 2 (16th month postoperatively)

Both patients were operated on with the same procedure. Metamizol sodium 10 mg / kg (Geralg-M, Text chemist, Turkey) intramuscularly (IM) and

cefazolin sodium 30 mg / kg of (Cefazolin, MN, Turkey) IM, and xylazine HCl 2 mg / kg (IM) (20 mg / ml (Alfazyne® EgeVet, Turkey) were applied preoperatively. Endotracheal intubation tube was placed in both patients after premedication. Induction was performed with ketamine HCl 20 mg / kg (100 mg / ml Alfamine® EgeVet, Turkey) IM and maintenance of the anesthesia provided by inhalation of sevoflurane 2-5% (Sevorane Liquid 100%, Abbot, USA). Routine preparations were completed by placing the patients on the operation table in the right lateral recumbency (Figure 3 a-b). Surgical site was reached by thoracotomy approach from the 4th lateral intercostal space (Figure 3 c). The right aortic arch was confirmed (Figure 3 d). The peri-esophageal fibrous bands and ligamentum arteriosum, which compress the esophagus, were carefully dissected. The ligamentum arteriosum was then ligated with double ligature at 1 cm spacing using absorbable (No:0) surgical suture (P.G.A.Ö, Çetin Chemistry, Turkey) (Figure 3 e). It was cut through the ligatures (Figure 3 f). Then, a Foley (14 Fr) catheter was then advanced to the distal esophagus and the

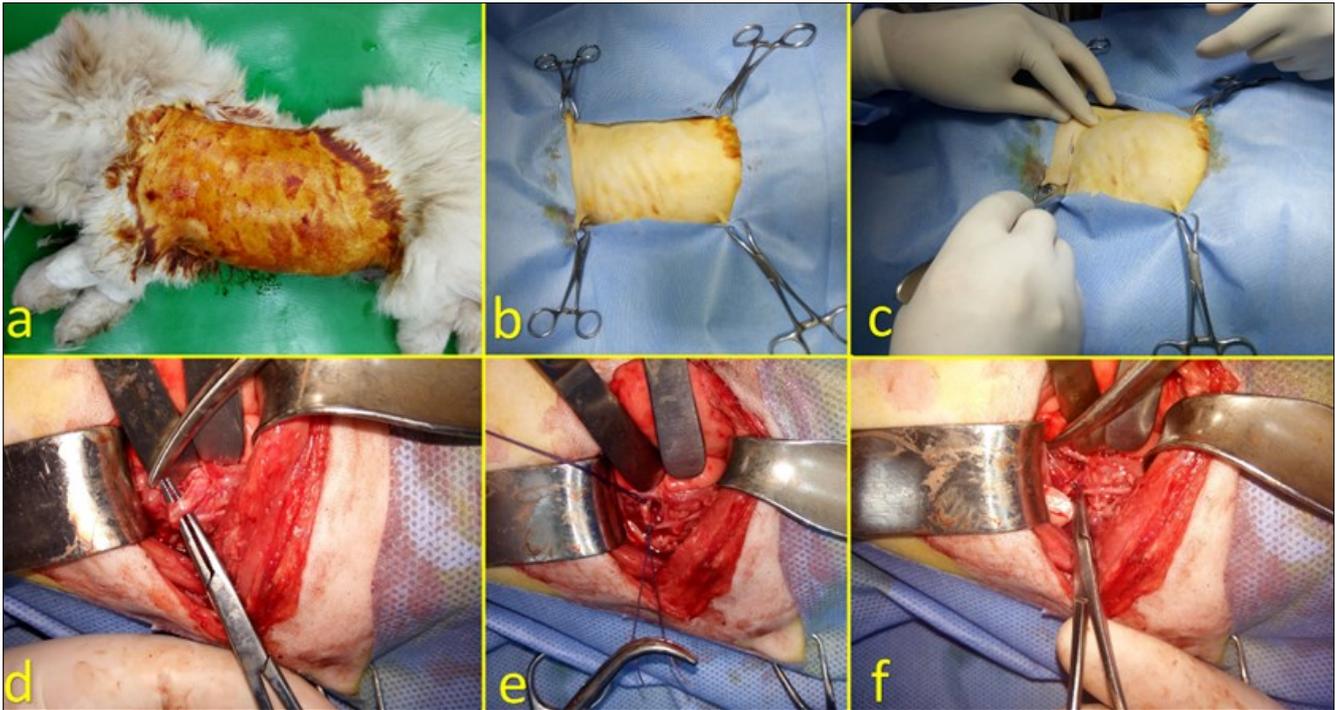


Figure 3. Surgical approach of case 1 diagnosed with vascular ring

balloon was inflated with 5 ml of saline. The catheter was pulled back and its passage from the caudal part to the cranial was tested. The Foley catheter was easily slipped in the esophagus and the passage was open. Following the elimination of the contraction, the operation was completed. Intercostal muscles, subcutaneous connective tissues and skin were closed with absorbable sutures routinely. The operation was ended with providing intra-thoracic negative pressure. Recovery of the cases were normal after the surgery. During surgery, 0.9 % saline (Poliflex, Polifarma, Turkey), 10 ml/kg /h was administered intravenously. Cefazolin sodium (cefazolin, MN, Turkey) 25 mg/kg IM was administered every 12 hours for 5 days, postoperatively.

In case 1, it was tried to stabilization of the patient firstly, and intensive care measures were taken. Although it was recovered completely from anesthesia, it died 2 hours after recovery. In case 2, it was discharged without any problem and recommended to feed with small amounts and frequent meals in vertical position for first month of postoperative period. Controls were performed at 1st, 4th, 9th, and 16th months postoperatively. Control radiographs revealed that the esophageal dilatation caused by the vascular ring regressed in the first month postoperatively, the animal gained

weight, its growth improved and clinical complaints resolved.

Discussion

Breeds reported with the diagnosis of vascular ring include German Shepherd, Labrador Retriever, Irish Setter, Mixed-breeds, Brittany Spaniel, Beagle, Great Dane, Miniature Schnauzer and Yorkshire Terrier in dogs (Macphail et al., 2001; Buchanan, 2004; Vianna and Krahwinkel, 2004; House et al., 2005; Du Plessis et al., 2006; Loughin and Marino 2008). The breeds that reported in this case report, Chow Chow and the Malinois-Siberian husky cross-breed were not included previous reports of VRA. Therefore, it is understood that the literature data are not sufficient for dogs with this anomaly. In our article searches, Malinois-Siberian husky cross-breed was not found among the breeds reported as mix breeds. The most common type of VRA is the permanent right aortic arch (PRAA) (Yalcin et al., 2009). In addition, persistent left subclavian artery with persistent right aortic arch, persistent left ligamentum arteriosum and left subclavian artery with persistent right aortic arch, double aortic arch, persistent right ligamentum arterium with normal left aortic arch, persistent arteria subclavia sinistra with normal left aortic arch and arteria subclavia sinistra and normal left aortic

arches have also been reported (Buchanan, 2004; Fossum, 2013). Although PRAA and left ligamentum arteriosum are common in dogs and cats, other vascular ring anomalies have been reported rarely (Koc et al., 2004). In both cases, the cause of vascular ring anomaly was peri-esophageal fibrous bands and ligamentum arteriosum.

One of the main pathophysiological causes of esophageal-associated vomiting has been reported to be vascular ring anomaly in dogs and cats. It can successfully treated by surgery (Cave, 2013). The loss of time with symptomatic treatment generally affects the success of surgery adversely. It has been confirmed once more in our cases that detailed clinical examinations are important for correct diagnosis, treatment and survival. It has been reported that vascular anomalies are also observed with PRAA and barium sulfate radiography is not sufficient for the diagnosis of vascular ring anomaly (Buchanan, 2004). We could not identify the type of vascular ring anomaly in our cases, but it was determined that vascular ring anomaly could be diagnosed with clinical experience and good radiographic information.

Cranial thoracic esophageal dilatation and esophageal stenosis on the base of the heart are the most important findings of radiography. Caudal thoracic esophageal dilatation (poststenotic dilatation) is rarely seen with vascular ring anomalies (Ellison, 1980). Radiography reveals the dilated esophagus, and after contrast radiography the strictured part of esophagus (Yalcin et al., 2009). Air, water and food accumulate in the dilated part of the esophagus. Indirect radiography with liquid barium sulphate shows the accumulation of contrast material in the dilated area (Fossum, 2013). Liquid barium sulphate (8 ml / kg PO, 30%) is given for the diagnosis of esophageal dilatation. Following, the ratio of the maximum esophageal dilatation area to the narrowest height of the fifth thoracic vertebrae (T5) should be ≤ 1 in normal dogs and cats. It should be considered mild dilatation if ≤ 2.5 , moderate if ≤ 4 , and advanced if > 4 (Fossum, 2013). In the present study, prestenotic esophageal dilation values were evaluated (Dilatation / T5) similarly to Fossum (Fossum, 2013). In case 1, indirect laterolateral

(LL) radiographs of the esophagus showed the presence of a moderate prestenotic dilatation (Dilatation / T5: 2.931) consistent with the thoracic permanent right aortic arch, whereas case 2 showed severe poststenotic esophageal dilatation (ED $>$ 4).

In persistent right aortic arched VRAs, the best surgical approach is performed through the left fourth intercostal space. After ligation, a folley catheter is introduced orally into the strictured area of the esophagus (Ellison, 1980). Our surgical approach was similar to Ellison. Differently, after dissection of the persistent right aortic arch, we checked the flexibility of the esophagus and the elimination of the contraction factor by Foley catheter. The thinness of the esophagus and the high risk of perforation require very careful dissection (Ellison, 1980). These complications are possible because dilatation disrupts the normal structure in the region and makes it fragile. However, with a careful surgery, possible complications were prevented. However, it was concluded that early and accurate diagnosis of patients is as important as operative care to ensure the well-being of the patient. Caliskan et al. reported that the studies were limited due to the very rare occurrence of vasculer ring anomalies (Caliskan et al., 2018). Therefore, two cases were evaluated in this study.

Conclusions

As a result; symptoms such as vomiting, flatulence and abdominal tension must be examined with detailed radiographs and possibility of the vascular ring anomaly should not be overlooked, or confused with other digestive system diseases. Early diagnosis is important. The surgical treatment may have a better prognosis in early treated cases. In addition to the surgical treatment, the diet is also required to be rearranged.

Acknowledgement

The authors would like to thank Halil ALAKUŞ and İbrahim ALAKUŞ for their support in the clinical work of the study.

Conflict of Interest

The authors declared that there is no conflict of interest.

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