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## Surgical management of a vascular ring anomaly associated with right aortic arch in a German shepherd dog

**Mamta Mishra, Akash, Amolok Sharma, Raveendra Tadagani and RP Pandey**

### Abstract

A 3 month old female German shepherd was presented to the Teaching Veterinary Clinical Complex, with a history of vomiting from past 1 week, weight loss, difficulty during respiration. The dog was dull and emaciated. The thoracic radiographs revealed radiolucent structure which was surrounded by radiopaque wall cranial to the base of heart and contrast oesophagography revealed oesophageal dilatation cranial to the base of heart, characterizing megaesophagus. A tentative diagnosis was made as persistent right aortic arch (PRAA). A left 4th intercostal thoracotomy was performed and the definitive diagnosis was made as PRAA. The surgical correction was by the ligation and transection of ligamentum arteriosum.

**Keywords:** German shephard, Persistent right aortic arch, Ligamentum arteriosum, thoracotomy

### Introduction

Vascular rings are developmental anomalies of the aortic arches in which the oesophagus and the trachea are encircled either completely or partially by vasculature (VanGundy, 1989) [11]. Persistent right aortic arch (PRAA) accounted for 95% of dogs with vascular ring compression of the oesophagus (Buchanan JW, 1968) [2]. The PRAA is most frequently diagnosed in young large-breed dogs (Shires and Liu, 1981) [10]. The dogs with vascular ring anomaly usually have the history of postprandial regurgitation of solid foods soon after weaning (Van Den Ingh and Van Der Linde-Sipman, 1974; Helphrey, 1993) [13, 5]. The affected dogs are stunted, thin and unthrifty (Helphrey, 1993; Muldoon *et al.*, 1997) [5, 8]. Tracheal deviation which is one of the reliable signs for diagnosing PRAA in direct radiography has been found to be sufficient for diagnosis by some authors (Buchanan JW, 2004) [3]. A presumptive diagnosis can be made based on the clinical history, clinical signs, oesophagography and oesophagoscopy whereas; the confirmative diagnosis is best made after surgical exploration (Muldoon *et al.*, 1997) [8]. Medical treatment (e.g. Liquid diets and supportive care) of PRAA has been shown to be unrewarding (Ellison, 1980; VanGundy, 1989) [11]. Thus, going through various literature it was found that the surgical ligation and transection of the ligamentum arteriosum is the recommended method of treatment. The purpose of this report is to present a vascular ring anomaly associated with persistent right aortic arch in a German Shepherd dog and its surgical correction.

### Materials and Methods

#### Case history and observations

A 3 month old female German shepherd was presented with a history of vomiting from past 1 week, weight loss, difficulty during respiration. On clinical examination pet was found to be dull, emaciated, and dehydrated, anaemic. Animal had earlier been treated for gastritis but there was no relief. Later it was suspected for foreign body and the thoracic radiographs was taken, it revealed some radiolucent structure surrounded by radiopaque wall cranial to the base of heart (Figure-1). Contrast radiography with barium meal revealed oesophageal dilatation cranial to the base of heart, characterizing megaesophagus (Figure-2). The condition was tentatively diagnosed as persistent right aortic arch (PRAA).

### Surgical procedure

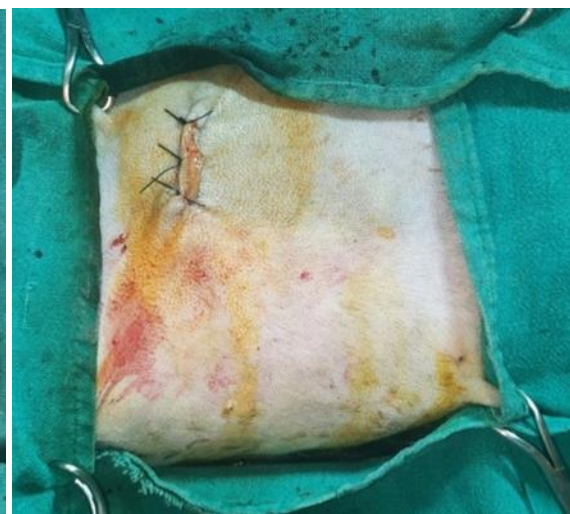
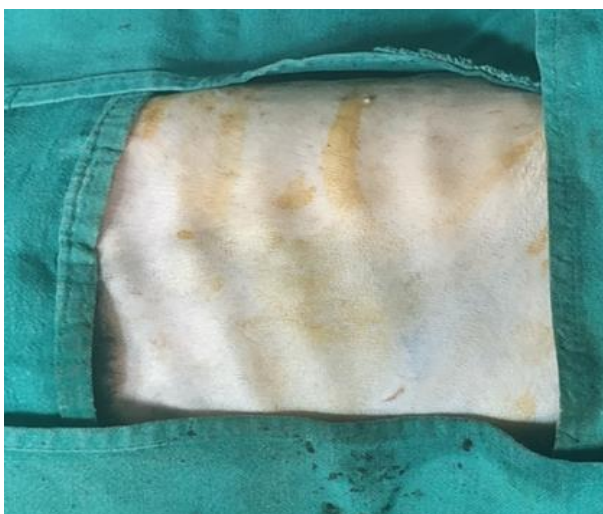
The dog was stabilized with ringers lactate solution, prophylactic administration of ceftriaxone (25mg/kg b.wt.) i/v, dexamethasone (1mg/kg b.wt.), meloxicam (0.2mg/kg b.wt.) i/m and prepared for aseptic surgery (Figure-3). The dog was premedicated with Atropine sulphate (0.04mg/kg b.wt.) i/m, Xylazine (1.5mg/kg b.wt.) i/m. Anaesthesia was induced with Ketamine (5mg/kg b.wt.) i/m and maintained with Isoflurane and positive pressure ventilation was maintained by anesthesia machine with manual ventilation. The animal was taken in right recumbancy, thoracic cavity was entered through a left lateral thoracotomy incision at the level of the 4<sup>th</sup> left intercostal space. The heart was exposed with its pleural covering and the vascular ring anomaly was identified (Figure-4). The oesophagus was found dually compressed, by a complete ring formed by the persistent right aortic arch and ligamentum arteriosum. The pleura was

incised to expose the LA. Transfixing sutures were placed at both ends of the ligamentum arteriosum with 3/0 Vicryl® and then it was transected (figure-5). The blood mixed fluid in the pleural cavity was suctioned out using tube inserted through surgical wound. The lungs were repositioned and inflated. Thoracocentesis was performed to establish negative pressure in thoracic cavity by using intravenous catheter connected to syringe. The surgical wound was closed by 3 layer suturing, the serratus ventralis and scalenus muscle in single layer. The latissimus dorsi muscle, the cutaneous trunci muscle, the subcutaneous tissue and skin were closed in separate layer (Figure-6).

Post operatively, ceftriaxone plus tazobactam (25mg/kg b.wt.) i/v, meloxicam (0.2mg/kg b.wt.) i/v, advised the owner to maintain the dog on fluid therapy with 5% dextrose, i/v for next 5 days and upright feeding of liquid diet from 10<sup>th</sup> post operative day.



**Fig 1:** Thoracic radiography showing radiolucent structure **Fig 2:** Contrast radiography showing oesophageal dilatation at the base of heart



**Fig 3:** Left lateral thoracotomy at the level of 4<sup>th</sup> intercostal space

**Fig 4:** Vascular ring anomaly identified



**Fig 5:** Ligamentum arteriosum transected



**Fig 6:** Surgical wound sutured



**Fig 7:** Dressing done postoperatively



**Fig 8:** Recovery

## Results and Discussions

PRAA and retention of the left ligamentum arteriosum is the most common vascular ring anomaly in both dogs and cats (VanGundy T., 1989<sup>[11]</sup>; Muldoon M.M., Birchard S.J., Ellison G.W., 1997<sup>[8]</sup>; Van der Linde-Sipman, J.S., Van Der Gaag, I., 1974<sup>[13]</sup>). The most affected dog breeds are Irish setters and German shepherds (Gunby JM, Hardie RJ, Bjorling DE., 2004<sup>[6]</sup>; Yalcin E, Celimli N, Cangul IT, Akkoc A, Yilmaz Z., 2009)<sup>[14]</sup>. Whereas in cats there is no breed predisposition. Persistent right aortic arch can be suspected based on clinical signs and history, but it should be confirmed by thoracic radiographs which demonstrate the megaesophagus and tracheal deviation, cranial to the base of heart. The clinical presentation of specific vascular ring anomalies may vary, but it is mostly complete encirclement of the oesophagus that leads to the clinical sign of regurgitation (Patterson 1968)<sup>[9]</sup>. Tracheal deviation which is one of the reliable signs for diagnosing PRAA in direct radiography has been found to be sufficient for diagnosis by some authors (Buchanan JW., 2004)<sup>[3]</sup>. Other vascular ring anomalies, including double aortic arch, left aortic arch and right ligamentum arteriosum, persistent left or right subclavian arteries, ductus arteriosus with normal aortic arch, persistent right dorsal aorta, and aberrant intercostal arteries, have been reported rarely (VanGundy T., 1989<sup>[11]</sup>; Van Den Ingh T.S., Van Der Linde-Sipman J.S., 1974<sup>[13]</sup>; Van der Linde-Sipman,

J.S., Van Der Gaag, I., 1974<sup>[13]</sup>; McCandlish, I.A.P., Nash, A.S., Peggram, A.1984)<sup>[7]</sup>. In this case, PRAA with left ligamentum arteriosum was the only abnormality. A presumptive diagnosis of PRAA was made on history, clinical signs, physical examination, thoracic radiographs. Medical treatment of PRAA (e.g. liquid diets and supportive care) has been shown to be unrewarding (VanGundy T., 1989; Ellison G.W. 1980)<sup>[11, 4]</sup>. Long-term results are poor because the oesophageal constriction remains and oesophageal dilation worsens with time (VanGundy T., 1989)<sup>[11]</sup>. Thus, surgical ligation and division of the ligamentum arteriosum is the recommended method of treatment (Ellison G.W. (1980)<sup>[4]</sup>. Most vascular ring anomalies can be corrected through a left-sided approach, including a double aortic arch (Aultman and others 1980, Buchanan 2004)<sup>[3]</sup>. In this case, the ligamentum arteriosum was identified, ligated and transected, and the underlying oesophagus was freed of any residual extramural fibrous bands. Some authors have suggested that age at the time of surgical correction of PRAA is an important factor in long-term prognosis (VanGundy T., 1989; Muldoon M.M., Birchard S.J., Ellison G.W. 1997; Hephrey M. 1993)<sup>[11, 8, 5]</sup>. Early surgical intervention has been recommended, because it was thought that oesophageal dilation and motility disorders would worsen and possibly become irreversible if surgery were delayed (Muldoon M.M., Birchard S.J., Ellison G.W., 1997)<sup>[8]</sup>. However, dogs <2 months old at the time of surgical

correction had a lower survival rate than did older dogs (Shires P.K., Liu W. (1981) <sup>[10]</sup>. In the present case dog was 3 month old shown well recovery after surgery and was doing well after surgery as per information given by the dog owner.

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