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Cardiovascular Images

Unilateral external jugular vein aneurysm in a dog[☆]



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KEYWORDS

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Abstract An 11-month-old Staffordshire Bull Terrier was referred with a two-month history of fluctuating unilateral jugular groove swelling, which appeared to enlarge after exercise. There was no history of trauma. Multimodal imaging findings (using transdermal and transesophageal ultrasound and dual phase computed tomography angiography) were consistent with large, saccular, left jugular vein aneurysm, running parallel to the left carotid artery. There did not appear to be any arteriovenous communication present. There were no cardiac abnormalities found on echocardiography. Following surgical excision, histopathological analysis supported the clinical suspicion of a congenital external jugular venous aneurysm.

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An 11-month-old Staffordshire Bull Terrier was referred to the Queen's Veterinary School Hospital to investigate a clinically asymptomatic, soft,

fluctuating, non-pulsatile, non-painful unilateral swelling in the left jugular groove, which became more prominent as the head was lowered and after

[☆] A unique aspect of the Journal of Veterinary Cardiology is the emphasis of additional web-based images permitting the detailing of procedures and diagnostics. These images can be viewed (by those readers with subscription access) by going to <http://www.sciencedirect.com/science/journal/17602734>. The issue to be viewed is clicked and the available PDF and image downloading is available via the Summary Plus link. The supplementary material for a given article appears at the end of the page. Downloading the videos may take several minutes. Readers will require at least Quicktime 7 (available free at <http://www.apple.com/quicktime/download/>) to enjoy the content. Another means to view the material is to go to <http://www.doi.org> and enter the doi number unique to this paper which is indicated at the end of the manuscript.

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exercise. There was no history of trauma (e.g. barbed collar, prior venipuncture or other); the swelling was suddenly noticed two months prior to referral and had enlarged during this period.

Image interpretation

Cervical transdermal and transesophageal ultrasonography revealed a large, aneurysmal dilation of the left external jugular vein with a large amount of spontaneous echo contrast but no thrombus was seen (Fig. 1, Video 1). The dilation was sacculated and extended towards the thoracic inlet, with no evidence of an arteriovenous malformation/communication. There was insufficiency of the jugular vein valve most distal to the aneurysm with 'to-and-fro' blood flow within the aneurysm (Videos 2A, 2B).

Supplementary video related to this article can be found at <https://doi.org/10.1016/j.jvc.2022.01.006>



Fig. 1 Ultrasonography of a large cervical swelling showing a severe aneurysm of the left external jugular vein with a large amount of spontaneous echo contrast.

To better characterize this vascular anomaly, dual phase computed tomography angiography (CTA) was performed using a 16 slice multidetector scanner^a. The images were acquired in soft tissue windows (soft tissue window width 350 Hounsfield unit, window level 50 Hounsfield unit) and the

^a Aquilion 16, Toshiba AmericaMedical Systems, CA, US.

venous angiograms were acquired with repeat scans from 30 to 90 s post administration of 2 mL/kg of iohexol (300 mgI/mL) at a rate of 2 mL/s into the left cephalic vein. This confirmed the presence of a saccular, left external jugular vein aneurysm (7.5 cm × 5.6 cm). On CTA, it was evident that bilaterally the external jugular veins were symmetrical at the confluence of the maxillary and linguofacial veins, after which the left external jugular vein formed two large compartments positioned dorsal and ventral to each other. The left subclavian vein also formed a focal dilation close to the confluence with the external jugular vein to form the left brachycephalic vein (Figs. 2 and 3; Videos 3, 4).

Supplementary video related to this article can be found at <https://doi.org/10.1016/j.jvc.2022.01.006>

Due to the location and dimension of the aneurysm, and the large amount of spontaneous echo contrast detected, antithrombotic treatment was initiated (clopidogrel 2 mg/kg PO q24h) and surgical excision occurred three weeks after initial diagnosis. The aneurysm and left subclavian vein were ligated and excised under general anesthesia in dorsal recumbency. The surgery went without complication. At follow-up six weeks post-surgery, the dog was clinically well and there was no cervical swelling. But a cervical transdermal ultrasonography showed the presence of a thrombus attached to the wall of the remanent left external jugular vein, distal to where the vein had been ligated. A repeated CTA and thrombolytic treatment options were discussed with the client but declined. Aspirin (1 mg/kg PO every other day) was initiated alongside clopidogrel at the dose stated above. Following this, the dog was lost to follow-up.

Histopathological examination of the excised tissue revealed an expanded venous structure consistent with that of a venous aneurysm (Fig. 4).

Discussion

Cervical venous aneurysms are rare vascular anomalies in humans [1] and have only been scarcely reported in dogs [2–4]. In the case described herein, we used advanced and multi-modality imaging to better characterize the jugular vein aneurysm and plan surgical approach.

In humans, venous aneurysms may be classified on the basis of etiology as primary or secondary [3,5]. The etiology of primary venous aneurysms is unknown, but there is speculation that congenital weakness or degenerative changes in the venous

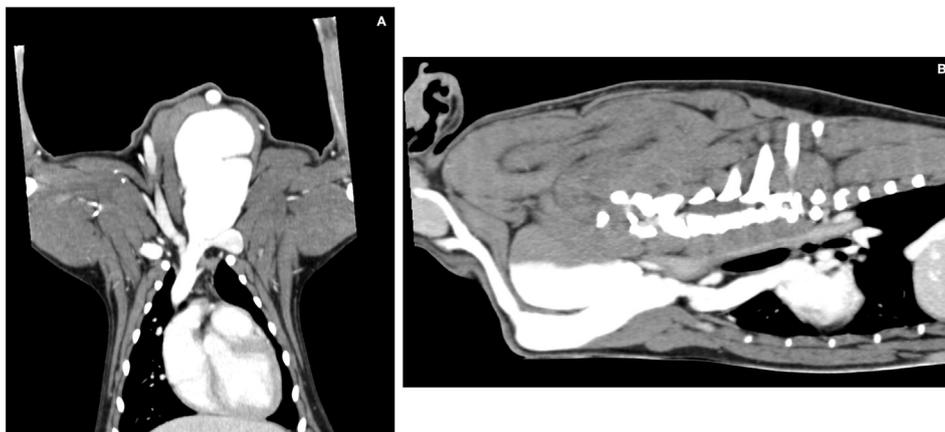


Fig. 2 Venous phase computed tomography angiography multiplanar reconstruction in the dorsal (2A) and left parasagittal plane (2B) demonstrating the left sided jugular vein aneurysm.

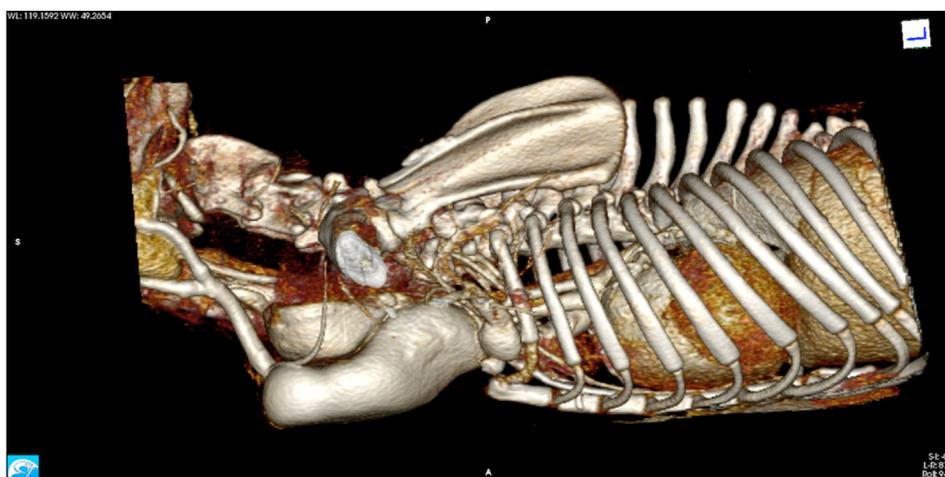


Fig. 3 Left lateral projection of the venous phase three-dimensional computed tomography angiography reconstruction of the aneurysm. The sacculated appearance of the aneurysm can be clearly seen.

wall due to a connective tissue disorder or local inflammatory process may result in aneurysm formation [3]. Histologically aneurysms can be classified as true aneurysms where all three layers of the normal vessel wall are present, but there is histopathological wall thinning [6] or pseudoaneurysms, which lack all three layers, and may be formed as a result of trauma [7,8]. Histologically, our presented case had marked luminal dilation with an undulant three-layered vascular wall that lacked reactive endothelium or luminal fibrin depositions. Additionally, no internal or external laminae were seen with the Van Gieson stain. These histological findings meet the criteria of a true venous aneurysm rather than the result of ongoing intravascular thrombosis due to vascular dilation with a three-layered full-thickness blood vessel wall; no internal or external elastic laminae

as would be expected in elastic arteries, and lack of any thromboses within the excised vessel lumen. A theory for the etiology of a congenital aneurysm is the thinning of the elastic and muscular layers of the venous wall resulting in weakening of the vessel wall [4]. Venous aneurysms may also occur secondary to other congenital venous anomalies such as arteriovenous fistula, venous hypoplasia, ectopia or agenesis, or be acquired secondary to trauma, neoplasia, or surgical intervention [3]. In the case herein reported, the exact etiology could not be determined, however, given the young age of the patient and no history of cervical trauma, congenital malformation was suspected.

Aneurysms of the venous system are usually asymptomatic in people [1,7,9]. However, deep venous thrombosis or pulmonary thromboembolism

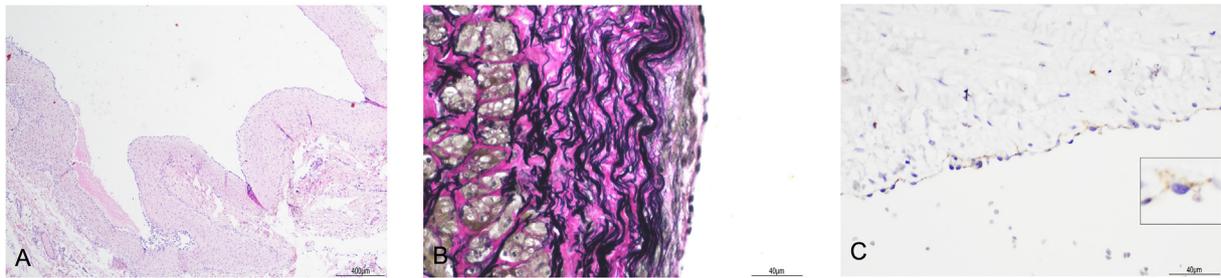


Fig. 4 Histopathology images of aneurysm wall, composed of three layers: the intima (innermost layer), composed of a thin monolayer of flattened endothelium, the media (middle layer) which is composed of a thick layer of connective tissue with numerous embedded elastic fibers, and the adventitia (outermost layer) composed of a thin layer of connective tissue; **A:** Aneurysmal wall (x10) with hematoxylin eosin stain. **B:** Elastin Van Gieson stain (x40) showing long, thick, black, wavy elastin bundles within the tunica media, surrounded by connective tissue. The subendothelial layer has thinner, shorter and paler elastin bundles. The intima consists of a monolayer of flat endothelial cells. **C:** immunohistochemical staining for CD31 (x40). The endothelium exhibits a mild, stippled, intracytoplasmic CD31 positivity. The remaining intima and media are negative. The inset shows a magnified CD31 positive endothelial cell.

have been reported to occur [1,3,4,7,9,10]. Clinical characteristics of a jugular aneurysm in humans are a non-painful, soft, non-pulsatile swelling which enlarges with breath holding [11]. Interestingly, in the case here described the swelling increased with cervical ventroflexion or after more vigorous physical activity, which could potentially be due to the increase in venous return/pressure.

Non-invasive diagnostic imaging techniques are recommended for definitive diagnosis. Ultrasonography is the most commonly used tool for easy and safe diagnosis of venous aneurysms [5–7], whereas CTA allows detailed anatomical evaluation of the aneurysm's anatomical borders and association to adjacent structures which is more informative for preoperative planning [5,11]. An arterial phase would be useful to assess any direct communication with adjacent arteries, when excluding an arteriovenous fistula.

The risk of cervical venous aneurysms expanding, rupturing, or resulting in thromboembolic complications seems to be minimal in humans [1,6]; however, pulmonary thromboembolism secondary to this type of venous malformation has been reported [9]. Considering the presence of spontaneous echo contrast in our case and that the patient was an active young dog, the risk of pulmonary thromboembolism or rupture guided the decision for surgical excision.

In this case report, we have described the presentation, diagnostic approach, and management for a dog presenting with an external jugular vein aneurysm. To the best of the author's knowledge, this is the first

report to combine the use of cervical and trans-esophageal ultrasonography and CTA for the diagnosis of an external jugular vein aneurysm in a dog.

Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jvc.2022.01.001>.

Video 1	Transdermal cervical ultrasound of the aneurysm showing a large amount of spontaneous echo contrast
Video 2A	Transdermal cervical ultrasound showing insufficiency of the jugular vein valve most distal to the aneurysm with 'to-and-fro' blood flow within the aneurysm
Video 2B	Transdermal cervical ultrasound with color flow Doppler interrogation of the aneurysm jugular vein valve showing the to-and-fro movement of blood within the aneurysm
Video 3	Venous phase three-dimensional computed tomography reconstruction of the aneurysm from right lateral, proceeding to ventral then left lateral approach
Video 4	Venous phase three-dimensional computed tomography reconstruction of the aneurysm from ventral, rotating anticlockwise 360°

References

- [1] Neto T, Balhau R, Coelho L, Pinto I, Correia-Sá I, Silva Á. Thrombosed aneurysm of the external jugular vein: a rare cause of cervical mass. *J Craniofac Surg* 2016;27:e36–7.
- [2] Salmeri K, Bellah J, Ackerman N, Homer B. Unilateral congenital aneurysm of the jugular, linguofacial, and maxillary veins in a dog [Internet] *J Am Vet Med Assoc* 1991;198:651–4.
- [3] Routh CE, Hagen RU, Else RW, Strachan FA, Yool DA. Imaging diagnosis—congenital venous aneurysm of the left external jugular vein. *Vet Radiol Ultrasound* 2009;50: 506–8.
- [4] Lefebvre M, Merveille A-C, Rizza M, Heimann M, Claeys S. Congenital venous aneurysm of the right external jugular vein in a great dane. *Vet Rec Case Rep* 2016;4:e000308.
- [5] Teter KA, Maldonado TM, Adelman MA. A systematic review of venous aneurysms by anatomic location. *J Vasc Surg Venous Lym Disord* 2018;6:408–13.
- [6] Calligaro KD, Ahmad S, Dandora R, Dougherty MJ, Savarese RP, Doerr KJ, McAfee S, DeLaurentis DA. Venous aneurysms: surgical indications and review of literature. *Surgery* 1995;117:1–6.
- [7] Vermeer NCA, Elshof JWM, Vriens PWHE. Clinical presentation, diagnosis, and treatment of venous aneurysms. *J Vasc Surg Venous Lym Disord* 2014;2:349–353.e3.
- [8] Maehara A, Mintz GS, Ahmed JM, Fuchs S, Castagna MT, Pichard AD, Satler LF, Waksman R, Suddath WO, Kent K, Weissman NJ. An intravascular ultrasound classification of angiographic coronary artery aneurysms. *Am J Cardiol* 2001;88:365–70.
- [9] Ioannou CV, Kostas T, Tsetis D, Georgakarakos E, Gionis M, Katsamouris AN. External jugular vein aneurysm: a source of thrombotic complications. *Int Angiol* 2010;29:284–5.
- [10] Lockwood AJ, Sinnott-Stutzman VB, Mouser PJ, Tsai SL. Azygos continuation of the caudal vena cava with segmental aneurysm, lung lobe torsion and pulmonary thromboembolism in a dog. *Clin Case Rep* 2018;6:363–9.
- [11] Nana P, Korais C, Mpouronikou A, Lachanas V, Spanos K, Kouvelos G. Management of an external jugular vein aneurysm in a young patient. *J Vasc Surg Venous Lym Disord* 2020;8:861–3.

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