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CASE REPORT
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Asymptomatic Ruptured Thymic Branchial Cyst in a Beagle Bitch - Successful Surgical Resection

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ABSTRACT

***Background*:** A thymic cyst is an extremely rare nontumorous thymic disease in dogs. The cyst may appear in the neck or thoracic regions and can cause clinical signs such as dyspnea and pleural effusion. Despite its benign behavior, it may occasionally lead to severe complications such as hemothorax if the cyst ruptures. Additionally, thymic cysts have the potential to compress vascular structures, cause pleural effusion, and, in rare instances, coexist with thymomas or progress to carcinoma, often necessitating surgical intervention for treatment. Imaging and cytologic evaluations present diagnostic limitations; therefore, histopathological examination is required for a definitive diagnosis. The objective of this study is to describe the clinical characteristics of dogs with ruptured thymic cysts, as well as to discuss the diagnostic and therapeutic approaches.

***Case*:** A 13-year-old spayed Beagle bitch, weighing approximately 20 kg, was presented for a medical checkup. The physical examination yielded no significant findings, and complete blood count, serum chemistry, and electrolytes showed no significant findings. However, thoracic imaging revealed an unexpected anterior mediastinal mass. Subsequent computed tomography confirmed a 55.9 × 68.5 × 54.6 mm partially fluid-filled mass adjacent to the heart but without the displacement of nearby structures or pleural effusion. Despite the absence of symptoms, surgical intervention was considered due to possible malignancy and to prevent further problems. Median sternotomy was performed for mass removal. The mass was adherent to the cranial vena cava, and we carefully extracted it while minimizing bleeding and preserving the integrity of adjacent organs. The sternum was secured using stainless steel wire, and the muscle, subcutaneous tissue, and skin layers were closed with conventional suturing methods. The removed mass had a solid appearance with some protrusions and a firm texture. Upon excision, it revealed a large cavity filled with serosanguineous fluid and several smaller cysts. Post surgery, the dog recovered well and was discharged on Day 10 without complications. Histopathological evaluation revealed thymic cysts with a central area of necrosis and hemorrhage, resulting from cyst rupture. A limited amount of thymic tissue, composed of thymic epithelial cells and small lymphocytes, was observed surrounding the cyst; however, no evidence of malignancy was identified. The dog lived for another three years without any thoracic issues before dying due to systemic disease. Notably, there was no recurrence of the thoracic condition, confirming the successful resolution of the initial concern.

***Discussion*:** The present study demonstrated the successful surgical treatment of an incidentally discovered ruptured thymic cyst in a Beagle bitch. Although thymic cysts in dogs are typically nonneoplastic, preoperative imaging often has limitations in diagnosis, and co-occurrence with neoplasms has also been reported. Furthermore, their rupture often leads to inflammation and hemorrhage, which necessitates surgical resection. The patient in this study was asymptomatic despite the rupture of the thymic cyst. The dog recovered without complications following cyst removal, and no recurrence was observed. Previously reported cases of thymic cysts in dogs have frequently documented serious complications such as pyothorax, hemothorax, and sepsis, as well as recurrence and progression to neoplasia. Based on the favorable outcome observed in this case, we recommend early surgical intervention prior to the onset of clinical symptoms of thymic cysts.

Keywords: dog, median sternotomy, thoracic mass, thymic cyst, thymoma.

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INTRODUCTION

Thymic disease in dogs is uncommon and may develop from residual tissue along the cell migration pathway from the branchial pouch. Thymoma and lymphoma are the most common diseases of the thymus, while nontumorous thymic cysts are extremely rare in canine cases [3]. Thymic cysts are believed to originate from the same source as branchial cysts and are derived from remnants of the thymus-pharyngeal duct. As a result, thymic branchial cysts can develop either in the subcutaneous region of the neck or at various locations within the thoracic cavity [6,10]. Thymic cysts can be diagnosed through imaging and pathological examination. Typically, on a computed tomographic (CT) scan, these cysts appear as thin-walled structures devoid of solid contents, and they do not show any signs of invasion into adjacent blood vessels [4]. Pathologically, thymic cysts present with a ciliated cuboidal epithelium lining, granulomatous eosinophilic material, septal adipose tissue, stromal elements, and clustered inflammatory cells near the cyst wall [4,12]. Once the thymic cyst ruptures, inflammation and hemorrhage tend to occur in both humans and dogs, and surgical resection is usually required [8,11,15].

The objective of this study is to describe the clinical characteristics observed in a Beagle bitch with ruptured thymic cysts, as well as to discuss the diagnostic and therapeutic approaches.

CASE

A 13-year-old spayed Beagle bitch, weighing approximately 20 kg, was presented for a medical check-up and regular evaluation of a cervical subcutaneous lipoma. The physical examination yielded no significant findings except for the presence of an existing cervical lipoma, and all blood test results, including calcium levels, were within the reference ranges, except for a minor increase in lipase. However, the thoracic radiograph revealed an anterior mediastinal mass, and there were no reported clinical symptoms associated with it during the history (Figure 1A). Subsequently, a CT scan revealed a thoracic mass in the anterior mediastinum posteriorly adjacent to the heart and closely positioned near the cranial vena cava without causing displacement, and it measured 55.9 × 68.5 × 54.6 mm (Figure 2). Additionally, no displacement of the trachea was noted. This mass exhibited partial fluid content and a thick wall and showed no evidence of vascular invasion. Additionally, the scan indicated no lesions associated with metastasis or pleural effusion. Auscultation revealed a heart murmur, and subsequent echocardiography confirmed the presence of grade 1 diastolic dysfunction.

The patient did not exhibit any clinical symptoms related to the thoracic mass; nevertheless, surgical removal was conducted as a precautionary measure due to potential malignancy and compression concerns. Prior to surgery, cefazolin[1] [25 mg/kg - IV, single dose] and midazolam[2] [0.2 mg/kg - IV, single dose] were administered as premedication. The ketamine[3]-lidocaine[4]-tramadol[4] (KTL) protocol, as previously described, was used, with an initial loading dose administered during induction and a continuous rate infusion maintained throughout the surgical procedure [7]. Anesthesia was induced using propofol[5] [6 mg/kg - IV, single dose], and inhalation anesthesia was maintained with isoflurane[6]. Before median sternotomy, a cervical lipoma was removed from the cranial aspect of the sternotomy site to improve the visibility of the surgical field. Following the opening of the thoracic cavity, anesthesia was sustained by applying a positive end-expiratory pressure of 5 cm H_2O. The patient was positioned in dorsal recumbency, and an oscillating saw was used to perform osteotomies on 6 segments of the sternum, with the incisions centered along the midline, resulting in two remaining sternum segments-one cranial and one caudal. The mass identified on the CT scan was then surgically removed utilizing a harmonic scalpel[7] to minimize bleeding during the excision process (Figure 3A). The mass was adherent to the cranial vena cava and was carefully separated from it and the surrounding tissues. This was followed by a thorough visual inspection to ensure the normalcy of nearby structures, and the surgical site was irrigated with warm saline before the placement of a chest tube. Furthermore, 0.5% bupivacaine[8] was infiltrated into the muscles around the osteotomy site to manage pain, the sternum was secured using stainless steel wire, and the layers of muscle, subcutaneous tissue, and skin were sutured in the usual manner. On external examination, the mass exhibited a solid appearance with some protrusions and a firm texture (Figure 3B). Upon excision and internal examination, both densely filled areas and empty spaces were observed, one of which was a large cavity filled with serosanguineous fluid, along with several smaller cysts (Figure 3C).

Histopathological examination revealed a central area characterized by necrosis and hemorrhage surrounded by a substantial band of granulation tissue (Figure 4A). Additionally, multiple benign cysts were identified at the periphery of this granulation tissue. The interior of the mass was lined with ciliated cuboidal epithelium containing eosinophilic secretions, and a limited amount of thymic tissue was found surrounding the cyst, accompanied by thymic epithelial cells intermingled with small lymphocytes (Figure 4B). Notably, there was evidence of granulomatous lymphoplasmacytic inflammation, and the presence of scar tissue ultimately led to the diagnosis of a ruptured thymic cyst with no evidence of malignancy.

Following the surgery, the patient's postoperative care included prophylactic antibiotics, gastroprotective medications, KTL and nonsteroidal anti-inflammatory drugs for pain management. The chest tube was assessed every 4 h during the postoperative period for negative pressure and chest drainage, and the tube was removed on postoperative Day 3 according to the criterion of less than 1-2 mL/kg/day. The patient was discharged from the hospital on postoperative Day 10, and daily radiographs were obtained, revealing no significant complications at the surgical site (Figure 1B). At the 1-year follow up, the patient exhibited no signs of recurrence, and there were no surgery-related complications (Figure 1C). Three years post surgery, the patient died due to systemic disease, and notably, no recurrence within the thoracic cavity was detected throughout this period.

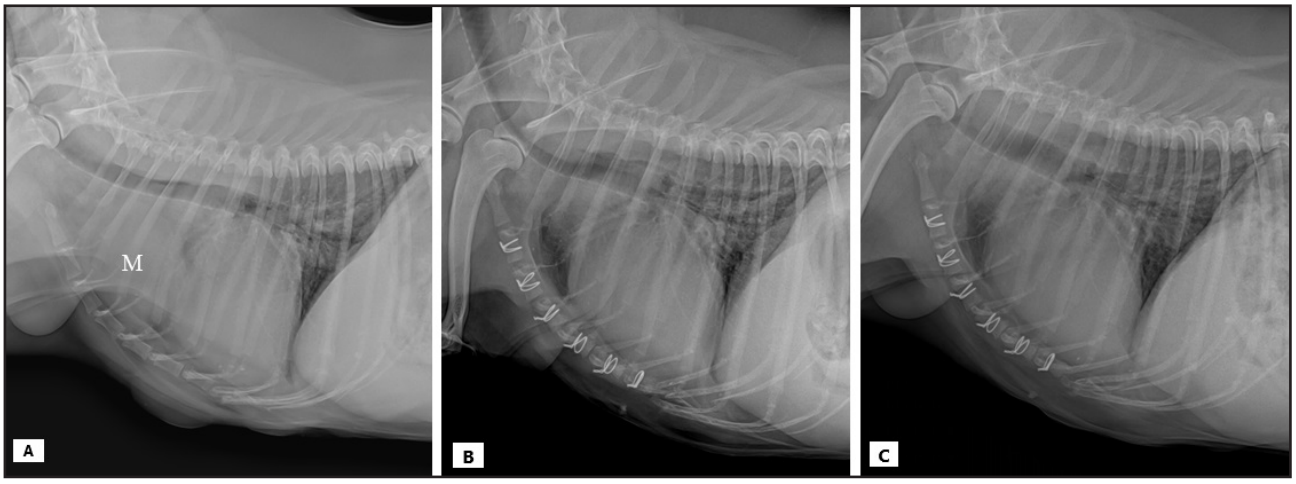

Figure 1. Pre- and postsurgical lateral thoracic radiographs. A- Preoperative imaging revealed soft tissue opacity in the anterior mediastinum, denoted as 'M' for the observed mass. B- Postoperative radiograph on Day 10 revealing the absence of the previously observed anterior mediastinal structure. C- The 1-year post surgery radiograph confirms the absence of surgical site recurrence and highlights the well-maintained sternal implants.

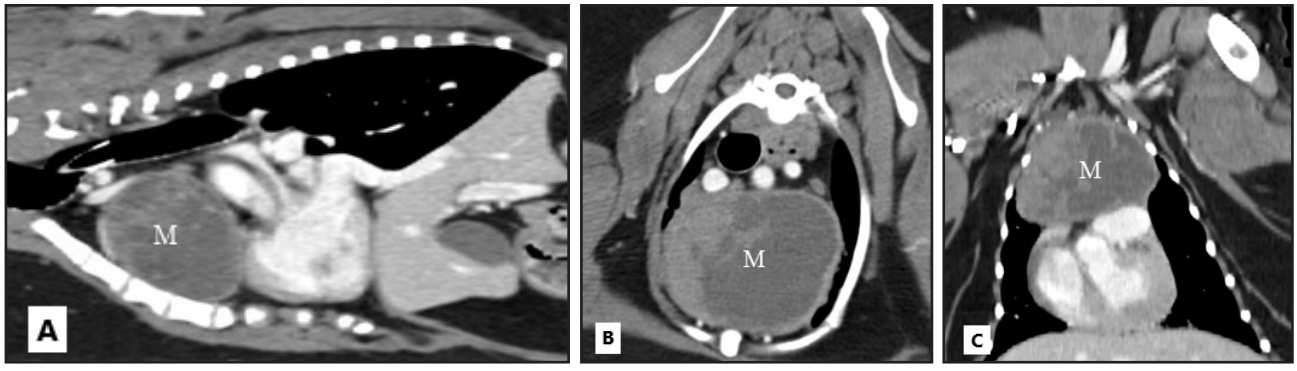

Figure 2. A preoperative computed tomography (CT) scan of the patient revealed an anterior mediastinal mass measuring as a width × height × length of 6.8 × 5.6 × 5.5 cm, indicating heterogeneous contrast enhancement. Additionally, noncontrast enhanced cystic structures were identified within the mass. No significant vascular invasion was observed. A CT scan also revealed a hepatic cyst in the left lateral lobe and a dense nodule in the right medial lobe. A- Sagittal view. B- Axial view. C- Coronal view.

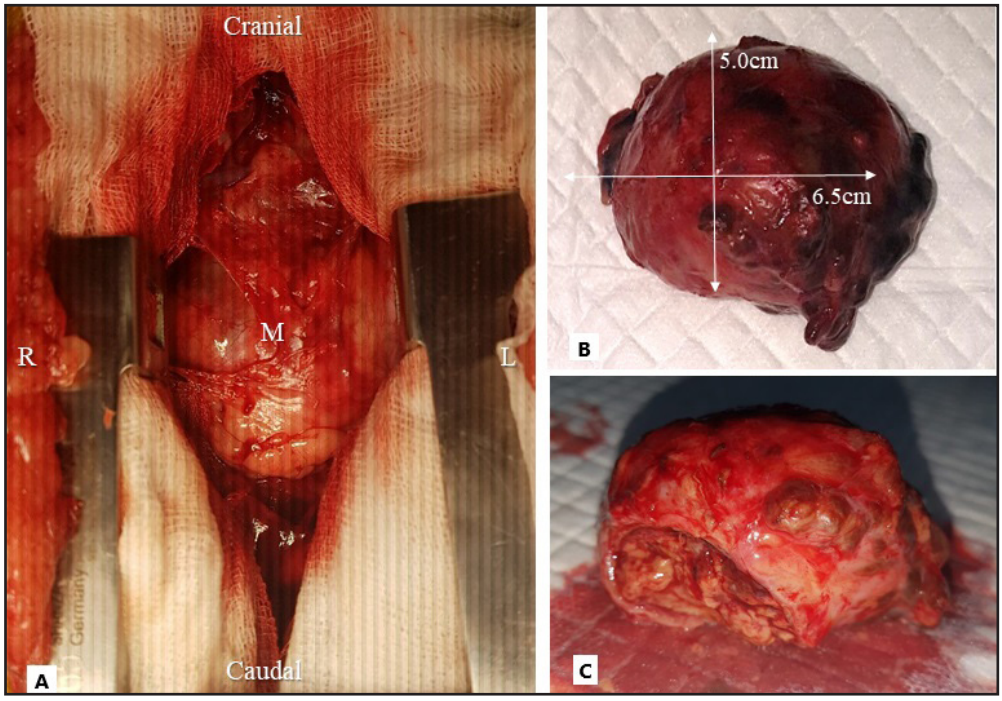

Figure 3. Anterior mediastinal mass. A- Immediate view poststernotomy. Surgical access to the mass was achieved through median sternotomy (M: mass). B- The removed mass measured 5.0 x 6.5 cm and was successfully removed without impacting the surrounding critical structures. C- A cross sectional view of the mass highlighting the densely filled portion on the right side.

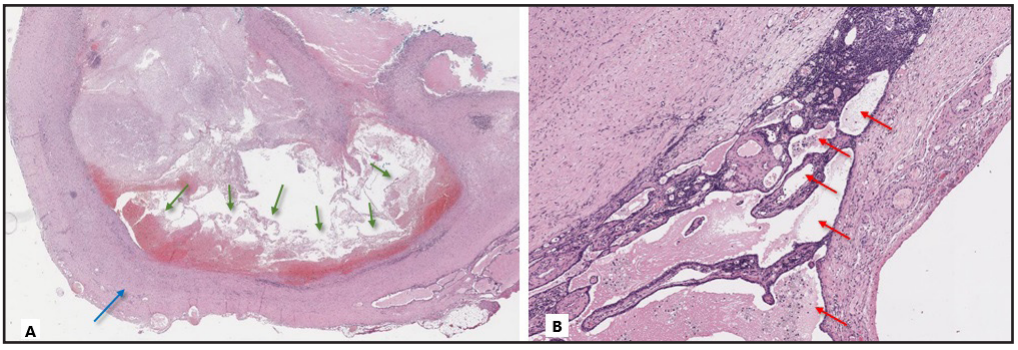

Figure 4. Histopathological analysis revealed a benign cystic lesion without any signs of malignancy. A- The image displays a central area of necrosis and hemorrhage (green arrow), bordered by a thick band of granulation tissue (blue arrow). B- Multiple cysts are observed at the periphery of the granulation tissue (red arrow). These cysts are lined by single layers of ciliated cuboidal epithelium and contain eosinophilic secretions. Adjacent to the cysts, a small amount of thymic tissue is noticeable, revealing a mixture of thymic epithelial cells and small lymphocytes.

DISCUSSION

In this study, we described a Beagle bitch with thymic cysts, a condition that is extremely rare in dogs. According to human studies, approximately 60% of patients with thymic cysts exhibit no symptoms [17]. Typical symptoms in humans include coughing, breathing difficulties, and chest pain. However, due to the limited data in dogs, a clear understanding of specific clinical signs is lacking; nevertheless, prior studies have indicated symptoms such as pericardial effusion, coughing, and hemorrhage in dogs diagnosed with thymic cysts [3]. In 15 dogs affected by thymic branchial cysts, the primary symptom was dyspnea, and the extent of pleural effusion ranged from mild to severe; however, out of the 7 dogs that underwent surgery, only 3 had a positive outcome [11]. In another study, 4 dogs diagnosed with thymic branchial cysts were identified as having additional conditions, such as Evan's syndrome, pericardial effusion, or lung tumors, and another study documented a case of a

thymic cyst in a dog with myasthenia gravis [3,16]. In contrast to the findings of previous studies, our patient was asymptomatic and lacked any of the mentioned comorbidities. An incidental finding of a ruptured thymic cyst was observed during diagnostic assessment, and the patient presented without discernible clinical symptoms or significant underlying medical conditions. Although histopathology revealed hemorrhage and inflammation within the cyst, both the preoperative and intraoperative evaluations showed no visible signs of significant bleeding or inflammation surrounding the cyst. Additionally, there was no evidence of nearby organ compression in either the CT scans or during the intraoperative assessment.

Studies in humans have indicated that the preoperative diagnosis of thymic cysts is challenging, even when employing various diagnostic methods, such as radiography, CT scans, and blood tests [14]. Preoperative blood tests may not be highly effective at diagnosing thymic cysts; however, they can help determine the presence of an infected mass [6]. CT is a valuable tool for assessing mediastinal masses because it provides in-formation about their anatomical location, size, and characteristics, while contrast imaging enhances the visualization of soft tissue, cysts, and vascular structures and their influence on neighboring structures, aiding in the differentiation of mediastinal diseases [2]. In human studies aiming to distinguish between thymic endothelial tumors and thymic cysts, crucial imaging indicators include postcontrast attenuation measured in Hounsfield units and the presence of protrusions according to CT characteristics [5,9]. In contrast to typical simple cysts that lack pure water density on CT scans, thymic cysts might exhibit greater CT attenuation due to their protein-rich content or the potential presence of hemorrhage. In our case, the CT scan indicated no significant vascularization or displacement of the trachea or heart due to the mass. However, the margin of the mass on CT was thicker than that of a typical cyst with a thin wall, and its internal area was not easily discernible as necrosis or typical cystic fluid. This made diagnosing it solely as a thymic cyst via CT challenging, hindering the exclusion of thymoma, the common diagnosis in such cases. One study found multiple cysts in canine thymomas, suggesting that the presence of a cystic structure does not definitively exclude the possibility of thymoma [16]. Moreover, when specific clinical symptoms are absent, as in this case, diagnosing the condition becomes more challenging, emphasizing the increased significance of performing a histopathological examination following surgical removal.

While thymic cysts are typically nonneoplastic, their gradual enlargement may lead to compression of blood vessels due to their spatial occupation. Compression from these cysts can lead to cranial vena cava syndrome; pleural effusion due to inflammatory reactions; and various clinical symptoms impacting the lungs, heart, and trachea [10,14]. Human studies have reported instances of thymomas originating from the linings of thymic cysts, and in dogs, rare cases of thymomas developing within cysts have been documented; for example, in a 2010 study in which a branchial cyst underwent carcinoma transformation and lung metastasis, there may be instances of persistent bleeding inside the branchial cysts [10,13]. Given the abovementioned limitations, surgical resection is advised, regardless of the initial presumption that the lesion was a cyst [6].

Generally, the postoperative prognosis for thymic cysts is favorable in human medicine. While serious postoperative complications are uncommon, possible issues may include damage to neck structures, hematoma, seroma, wound infections, and wound dehiscence. Although there is a theoretical risk of cyst recurrence after simple drainage, there have been no documented cases of thymic cyst recurrence following surgical excision [6]. In contrast to human cases, case studies on thymic cysts in dogs have indicated a less favorable prognosis. Among the reported cases, one with carcinoma developing within a thymic cyst exhibited a favorable long-term outcome postsurgery, whereas another instance featuring carcinoma and pulmonary metastases resulted in septic shock due to pyothorax by postoperative Day 9 [1,10]. Among the 7 dogs that underwent surgery in one study, only 3 had favorable long-term outcomes, while another study documented a preoperative fatality resulting from hemothorax [11,13]. However, due to the limited number of reported cases, there are not enough data available to establish a comprehensive prognosis. The difference in prognosis between dogs and humans may arise from species-specific factors, yet the exact reasons for this difference remain unclear due to the lack of extensive research on thymic cysts in dogs. In the author's opinion, symptom recognition in dogs largely depends on owner observation, possibly leading

to veterinary visits when symptoms are more severe, unlike in humans, who might seek medical attention for milder symptoms.

A limitation of our study was that additional testing was not conducted on the cyst fluid. Despite the patient's blood tests showing no signs of infection, a culture test would have been crucial for a more comprehensive diagnosis. Thymic cysts, classified as either congenital or acquired depending on their origin, can develop from infection or neoplasms in acquired cases. While human studies utilize histologic features to differentiate between these types, this method has not been explored in veterinary medicine due to the rarity of this condition [4]. However, the patient in this study recovered without complications with only general postoperative care, and no recurrence was confirmed; thus, the possibility of infection was considered low.

In this case of an incidental finding of a ruptured thymic cyst in a 13-year-old Beagle bitch, the discovery during routine evaluation underscores the diagnostic challenges associated with thymic cysts in veterinary practice. The decision for surgical intervention, despite the absence of symptoms, led to a positive outcome. This successful recovery without recurrence or complications underscores the significance of histopathological examination postsurgery, revealing the challenges in the preoperative diagnosis of thymic cysts in dogs. While typically nontumorous, thymic cysts may cause vessel compression, inflammation, and bleeding and, in rare instances, evolve into thymomas. Hence, early surgical removal, even in suspected cystic cases, is advisable to prevent potential complications.

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REFERENCES

1 **Alzahran A., Shebli B., Dabbas S., Sawas J., Khalili J., Zaki Karzoun M., Alhasan A. & Abdullah M. 2021.** Rare mediastinal thymic cyst infection without predisposing disease: a case report. *JRSM Open*. 12(4): 1-4. DOI:10.1177/2054270421991801.

2 **Choi H.J., Lee Y.W., Kim J.H., Shin C.H., Park K.T., Yeon S.C., Lee H.J. & Lee H.C. 2011.** Medical Imaging of Thymoma in a Dog. *Journal of Veterinary Clinics*. 28(4): 460-465.

3 **Day M. 1997.** Review of thymic pathology in 30 cats and 36 dogs. *Journal of Small Animal Practice*. 38(9): 393-403. DOI: 10.1111/j.1748-5827.1997.tb03492.xCitations: 143.

4 **Goldstein A.J., Oliva I., Honarpisheh H. & Rubinowitz A. 2015.** A tour of the thymus: a review of thymic lesions with radiologic and pathologic correlation. *Canadian Association of Radiologists Journal*. 66(1): 5-15. DOI: 10.1016/j.carj.2013.09.003.

5 **He Z.L., Wang Z.Y. & Ji Z.Y. 2022.** Special Computed Tomography Imaging Features of Thymic Cyst. *International Journal of Clinical Practice*. 2022(1). 6837774. DOI:10.1155/2022/6837774.

6 **Ji H. & Gantwerker E. 2017.** Cervical thymic cysts. *Operative Techniques in Otolaryngology-Head and Neck Surgery*. 28(3): 183-189. DOI: 10.1016/j.otot.2017.05.018.

7 **Kaka U., Rahman N.A., Abubakar A.A., Goh Y.M., Fakurazi S., Omar M.A. & Chen H.C. 2018.** Preemptive multimodal an algesia with tramadol and ketamine–lidocaine infusion for suppression of central sensitization in a dog model of ovariohysterectomy. *Journal of Pain Research*. 11: 743-752. DOI: 10.2147/JPR.S152475. eCollection 2018

8 **Lachanas E., Konofaos P., Birba G. & Tomos P. 2006.** A rupture of a huge thymic cyst into the pleural cavity: A case report. *Respiratory medicine*. 100(10): 1858-1860. DOI: 10.1016/j.rmed.2005.12.013.

9 **Lee S.H., Yoon S.H., Nam J.G., Kim H.J., Ahn S.Y., Kim H.K., Lee H.J., Lee H.H., Cheon G.J. & Goo J.M. 2019.** Distinguishing between thymic epithelial tumors and benign cysts via computed tomography. *Korean Journal of Radiology*. 20(4): 671-682. DOI: 10.3348/kjr.2018.0400.

10 **Levien A., Summers B., Szladovits B., Benigni L. & Baines S. 2010.** Transformation of a thymic branchial cyst to a carcinoma with pulmonary metastasis in a dog. *Journal of Small Animal Practice*. 51(11): 604-608. DOI: 10.1111/j.1748-5827.2010.01006.x.

11 **Liu S., Patnaik A. & Burk R. 1983.** Thymic branchial cysts in the dog and cat. *Journal of the American Veterinary Medical Association*. 182(10): 1095-1098.

12 **Newman A. 1971.** Cysts of branchial arch origin in the thymus of the Beagle. *Journal of Small Animal Practice*. 12(12): 681-685. DOI: 10.1111/j.1748-5827.1971.tb06196.x.

13 **Rickman B. & Gurfield N. 2009.** Thymic cystic degeneration, pseudoepitheliomatous hyperplasia, and hemorrhage in a dog with brodifacoum toxicosis. *Veterinary Pathology*. 46(3): 449-452. DOI: 10.1354/vp.08-VP-0193-R-BC.

14 **Tollefsen I., Yoo M., Bland J.D. & Nysted A. 2001.** Thymic cyst: is a correct preoperative diagnosis possible? Report of a case and review of the literature. *European Journal of Pediatrics*. 160: 620-622. DOI: 10.1007/s004310100817.

15 **Tsuda K., Yoshida I., Ohshima K. & Morishita Y. 1997.** Ruptured thymic cysts with mediastinal hemorrhage and hemothorax-a case report and reviews of the literature. *Nihon Kyobu Geka Gakkai*. 45(9): 1654-1659.

16 **Uchida K., Awamura Y., Nakamura T., Yamaguchi R. & Tateyama S. 2002.** Thymoma and multiple thymic cysts in a dog with acquired myasthenia gravis. *Journal of Veterinary Medical Science*. 64(7): 637-640. DOI: 10.1292/jvms.64.637.

17 **Wang X., Chen K., Li X., Li Y., Yang F., Li J., Jiang G., Liu J. & Wang J. 2017.** Clinical features, diagnosis and thoracoscopic surgical treatment of thymic cysts. *Journal of Thoracic Disease*. 9(12): 5203. DOI: 10.21037/jtd.2017.10.148.