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Canine tonsillar polyps: characteristics, classification and review of the pathogenesis

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Keywords:	hamartoma, oropharynx, pathogenesis, polyp, tonsil, Dog < Domestic Mammals < Species, review
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Canine tonsillar polyps: characteristics, classification and review of the pathogenesis

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Abstract

Canine tonsillar polyps are uncommon. We describe 14 tonsillar polyps in dogs and review their classification and pathogenesis. All dogs were adult (3-13 years old). Females (10/14) were more affected than males (4/14). Most of the lesions were asymptomatic (10/14). All lesions were unilateral, pedunculated (9/14) or sessile (5/14), with a smooth (12/14) or papillary/verrucous surface (2/14). Histologically, polyps consisted of benign proliferation of lymphatic vessels, blood vessels, fibrous tissue and lymphoid tissue in variable proportions, with occasional adipose tissue (4/14). According to the main stromal components, polyps were categorized as lymphangiomatous (5/14), lymphangiolipomatous (2/14), lymphangiofibromatous (2/14), angiofibromatous (1/14), angiofibrolipomatous (1/14), lymphoid (2/14), and myxomatous (1/14). As the pathogenesis of these polyps remains unclear, we propose to replace the term inflammatory tonsillar polyp by a morphological diagnosis based on the stromal characteristics of the lesions. Simple surgical excision was curative in the 9 cases with available follow-up information.

Keywords: dog, hamartoma, oropharynx, pathogenesis, polyp, review, tonsil

Benign proliferative tonsillar lesions are infrequent in dogs. Only 10 canine tonsillar polyps and an epithelial cyst have been reported, among 3 publications and a conference proceeding.[3,5,11,13] Histologically, most of the lesions are composed of mature fibrovascular stroma with multifocal aggregates of lymphocytes and plasma cells, and have been defined as inflammatory polyps.[11,20] Predominance of dilated lymphatic vessels within a dense fibrovascular stroma have been described only rarely.[3,13]

Benign tonsillar polyps in humans are mostly considered hamartomatous growths containing vascular, connective, lymphoid and fat tissue in variable proportions.[7,8,12] As in dogs, human tonsillar polyps are infrequent but the real incidence is unknown.[7,12] Histologically, polyps are recommended to be classified according to the most prominent stromal component and, in contrast to dogs, different histotypes have been reported including lymphangiomatous, lymphangiectatic, fibrous or fibrolipomatous, lymphoid, fibroepithelial.[2,7,12,17]

The objective of this report is to describe the clinicopathological characteristics of 14 tonsillar polyps in dogs, review their classification, and compare the canine lesion to known pathogenesis in humans.

Our records included 402 canine cases with tonsillar histopathology from 1995 to 2020. From those, 14 were selected because the descriptions were consistent with tonsillar polyps. Samples had been fixed in 10% neutral-buffered formalin, processed routinely, and stained with hematoxylin and eosin. Microscopic characteristics of each case were re-examined by two board-certified pathologists (JM, GAR). Vascularization, edema, and degree of inflammation were graded on a 0–3 scale (0, absent; 1, mild; 2, moderate; 3, marked). Vascular spaces, lymphoid, fibrous and fat tissue were graded on a 0–

4 scale based on percent (0, absent; 1, 1–25%; 2, 26–50%; 3, 51-75%; 4 >75% stroma). Clinical data and follow-up information were obtained through e-mail and telephone interviews with the referring clinicians.

Clinical and macroscopic data are shown in Table 1. Age of the dogs ranged from 3 to 13 years (mean 9.3). Females (10/14) were more affected than males (4/14). All patients presented with a unilateral, variably sized polyp emerging from the surface of palatine tonsil. Polyps were located on the right (6/14), left (4/14), or unreported (4/14). Most dogs were asymptomatic; only 4/12 (33%) cases showed clinical signs consisting of mouth bleeding (case 7), cough (case 10), retching (case 10,14) and dyspnea (case 13). Follow-up information was available in 9/14 (64%) cases, none of which showed local recurrence after simple surgical excision.

Nine of 14 (67%) polyps were pedunculated and 5/14 (36%) were sessile. The total length of the polyps ranged from 1 cm to 3.8 cm (mean, 1.93 cm) and the diameter from 0.3 to 1.4 cm (mean, 0.69 cm). Polyps showed a smooth (12/14), papillary (1/14) or verrucous (1/14) surface. Cut section was white to yellow and varied from soft and spongy (9/14) to firm and fibrous (4/14) to gelatinous (1/14).

Polyps were categorized into different histological subtypes according to the main constituents of their stroma. Histologic characteristics of each case are shown in Supplemental Table S1.

Seven of 14 polyps (57%) were diagnosed as lymphangiomatous. Lesions showed a highly vascularized stroma with abundant dilated endothelial-lined cavities and interconnected vascular channels, compatible with lymphatic

vessels (Figs. 1, 2). Lymphatics were empty or filled by eosinophilic fluid, and were separated by hypocellular, dense fibrovascular tissue occupying <50% of the stroma (Fig. 2). In 2/14 lesions, 25-50% of the stroma was infiltrated by adipose tissue and were subclassified as lymphangiolipomatous (Supplemental Fig. S1). Expanded subepithelial lymphoid follicles were multifocally present (Supplemental Fig. S2). Polyps were covered by stratified squamous epithelium with mild to moderate irregular hyperplasia (Supplemental Figs. S2-S4). Multifocally, the stroma elevated the surface forming small nodular projections and, in one case, causing a verrucous appearance (Supplemental Fig. S4). Acute necrotic changes including fibrinoid necrosis of blood vessel walls and intravascular fibrin thrombi were rarely seen (case 1; Supplemental Fig. S5), without associated clinical signs.

Four of 14 cases (29%) showed a predominantly fibrous stroma with numerous, slightly-dilated and non-anastomosing vessels. In 2 of the 4, lymphatics predominated and were categorized as lymphangiofibromatous (Supplemental Fig. S6). The other 2 of these 4 polyps showed a predominance of blood vessels and were classified as angiofibromatous (1/4) or angiofibrolipomatous (1/4) based on adipose tissue occupying more than 25% of the stroma (Figs. 3, 4).

Two of the 14 cases (14%) were classified as lymphoid polyps. More than 80% of the stroma was occupied by lymphoid tissue organized in coalescing, variable-sized follicular structures with reactive germinal centers surrounding a fibrovascular core (Figs. 5, 6). The presence of reticular epithelium transmigrated by large numbers of lymphocytes was more abundant in lymphoid polyps than in other histological subtypes (Fig. 5 inset).

Finally, one of 14 cases (7%) was categorized as myxomatous (case 14). The stroma was occupied by severe hypocellular myxomatous edema containing few interspersed spindle cells without atypia on loose fibrovascular stroma (Figs. 7, 8). At the base of the polyp, the vascular density was increased (Fig. 9). The surface epithelium showed moderate hyperplasia, intracellular and intercellular edema, and occasional intraepithelial vesicles (Fig. 7 inset).

All polyps showed a mild to moderate inflammation with multifocal infiltrates of lymphocytes and plasma cells, with occasional presence of neutrophils (Fig. 8 and Supplemental Figs. S1, S6).

Ten cases of canine tonsillar polyps were previously reported [3,11,13] and 14 are described herein. Although tonsillar polyps mainly affect adult dogs, they can affect dogs as young as 3 years (case 9).[3,11,13] Human lymphangiomatous polyps are more frequent in young adults, while lymphoid polyps commonly affect children.[2,7,8,12] No sex predisposition has been reported for canine or human tonsillar polyps, except for the lymphoid subtype which is more common in males.[2,7,8,11,12] In dogs, females were more affected than males but the overall numbers were too few to determine a sex predilection. All tonsillar polyps reported in dogs were unilateral without side predilection.[3,11,13] In humans, most polyps are unilateral but bilateral involvement has been rarely observed.[6-8,12] Canine tonsillar polyps are mostly asymptomatic. Only 8/22 (36%) dogs, including the 12 with clinical information in this series, showed clinical signs of lethargy, chronic dyspnea, coughing, gagging, retching or episodes of oral bleeding.[3,11,13] Human tonsillar polyps might be asymptomatic or associated with dysphagia, dyspnea, foreign body sensation, sore throat, tonsillitis and cough, depending on the size of the lesion.[7,8,12]

Canine and human tonsillar polyps can present as pedunculated or sessile masses with smooth or papillary surface.[3,7,8,11-13] Canine tonsillar polyps in this series were mostly pedunculated with smooth surface. This contrast with observations from the previously reported case series in which only 3/8 polyps were pedunculated.[11]

As in humans, the stroma of canine tonsillar polyps was composed by variable proportions of lymphatic and blood vessels, fibrous tissue, lymphoid tissue, and occasionally fat tissue, leading to different histomorphology that allow their classification into different histological subtypes.[2,7,8,12]

Lymphangiomatous polyps were the most common histological subtype in this case series. They show identical features to those previously reported in an adult dog and in humans.[7,13] These type of polyps have also been referred as tonsillar lymphangiomas by human pathologists.[12] However, tonsillar lymphangiomatous polyps have smaller lymphatic spaces and more fibrous and lymphoid stromal elements than lymphangiomas found elsewhere.[12] Canine lymphangiomas usually affect the skin of young dogs, and involvement of internal tissues is rare and mostly associated to a lymphangiomatosis syndrome with systemic involvement.[16]

The histomorphology of angiofibromatous polyps in our series is similar to those described by Lucke et al[11] as canine tonsillar inflammatory polyps, and to the stroma of canine and feline nasopharyngeal and middle ear polyps.[9,15] In contrast to tonsillar polyps, nasopharyngeal and middle ear polyps are usually partially covered by pseudostratified ciliated columnar epithelium and the stromal core and peduncle are less vascularized.[9,15] The main differential diagnosis considered for angiofibromatous and angiofibrolipomatous polyps

was angiofibroma. Due to the lack of infiltrative growth, the stromal fat infiltration, and the lower cellularity in these polyps when compared to canine nasal angiofibromas, this diagnosis was excluded.[4]

One polyp was classified as myxomatous. To the best of our knowledge, such histological appearance has not been described in human or canine tonsillar polyps. The highly edematous appearance of this polyp might be secondary to inflammation, as suggested for similar stromal changes in nasopharyngeal and laryngeal canine and feline polyps.[9,18,19]

The pathogenesis of benign tonsillar polyps is unclear. While an inflammatory origin has been suggested for canine lesions, the most accepted theory in human pathology considers these polyps as hamartomas.[2,7,8,11,12,20] This is further supported by the evidence of a disorganized distribution of fibronectin and collagens I and III within the stroma of tonsillar polyps regardless of their histomorphology.[1] Therefore, tonsillar hamartomas could present a variable histologic spectrum including polyps with fibrous/fibrovascular, lymphangiomatous, lymphoid and/or, more rarely, lipomatous appearances.[2,7,8,12] A second theory involves chronic inflammatory hyperplasia with irreversible lymphatic obstruction and lymphangiectasia, eventually causing mucosal prolapse and formation of a polyp.[8,12] Evidence against this explanation is that chronic tonsillitis occurs more commonly than polyps, and many patients with polyps lack a history of tonsillitis.[7,8,12] A clinical history of previous episodes of tonsillitis was not indicated in any of our cases or those previously reported.[3,11,13] Partial polyp torsion with subsequent lymphangiectasia and acute inflammatory and necrotic changes is possible in lesions with a long peduncle, as observed in our series (case 1).

As in humans, the pathogenesis of canine tonsillar polyps may involve a multistep process with an initial hamartomatous growth followed by secondary inflammatory and degenerative changes.[1,12] Secondary chronic inflammation in human tonsillar polyps causes stromal remodeling and lymphoid hyperplasia, occasionally producing lymphoid polyps.[1,2,12] These are characterized by a stroma composed predominantly of lymphoid tissue (>80%) organized in follicles around a fibrovascular core, similar to that observed in cases 12 and 13.[1,2] To the best of our knowledge, tonsillar lymphoid polyps have not been previously described in veterinary medicine.

Fat tissue was present in 4 of the lesions and, when occupying >25% of the stroma, the term lipomatous was added to the morphological diagnosis. Adipose tissue infiltration within some polyps probably reflects chronic degenerative and metaplastic stromal changes.[7,10,14]

In conclusion, canine tonsillar polyps are benign unilateral and usually asymptomatic lesions of adult dogs, with excellent response to surgical resection. They are composed of lymphatics, blood vessels, fibrous, lymphoid and fat tissue in variable proportions, producing different histomorphology. As in humans, a hamartomatous origin with superimposed inflammatory changes may be considered. We propose replacing the term inflammatory tonsillar polyp with morphological diagnoses based on the stromal characteristics.

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Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Figure legends

Figures 1-4. Polyps, tonsil, dog. **Figures 1-2.** Lymphangiomatous polyp, case No. 1. **Figure 1.** Pedunculated polyp with numerous dilated vascular cavities in the stroma. Large aggregates of lymphocytes are within the subepithelial space. Hematoxylin and eosin (HE). **Figure 2.** Dilated lymphatic vessels with occasional valves are present amid scant fibrous stroma. HE. **Figures 3-4**. Angiofibrolipomatous polyp, case No 8. Sessile polyp with abundant fibrous stroma that multifocally contains adipose tissue. Numerous congested blood vessels are concentrated in the stromal core. HE.

Figures 5-9. Polyps, tonsil, dog. **Figures 5-6.** Lymphoid polyp, case No**.** 13. **Figure 5.** Sessile polyp with stroma composed of large hyperplastic lymphoid follicles surrounding a fibrovascular core. Inset: the polyp is covered by stratified epithelium and tonsillar reticular epithelium transmigrated by lymphocytes. HE. **Figure 6.** Secondary antigen-polarized lymphoid follicles with expanded germinal centers surrounded by a thin mantle zone. Inset: germinal centers contain tingible-body macrophages. HE. **Figures 7-9.** Myxomatous polyp, case No. 14. **Figure 7.** Pedunculated polyp with severely edematous stroma and a fibrovascular pedicle. A transition line between the two areas is seen (arrowheads). Inset: Intraepithelial and subepithelial vesicles containing edema. HE. **Figure 8.** Edematous stroma contains small numbers of spindle cells and mild multifocal to diffuse mononuclear inflammatory infiltrates. HE. **Figure 9.** Fibrovascular pedicle with numerous congested blood vessels and empty lymphatic vessels at the base. HE.

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Abstract

Canine tonsillar polyps are uncommon. We describe 14 tonsillar polyps in dogs and review their classification and pathogenesis. All dogs were adult (3-13 years old). Females (10/14) were more affected than males (4/14). Most of the lesions were asymptomatic (10/14). All lesions were unilateral, pedunculated (9/14) or sessile (5/14), with a smooth (12/14) or papillary/verrucous surface (2/14). Histologically, polyps consisted of benign proliferation of lymphatic vessels, blood vessels, fibrous tissue and lymphoid tissue in variable proportions, with occasional adipose tissue ~~infiltration~~ (4/14). According to the main stromal components, polyps were categorized as lymphangiomatous (5/14), lymphangiolipomatous (2/14), lymphangiofibromatous (2/14), angiofibromatous (1/14), angiofibrolipomatous (1/14), lymphoid (2/14), and myxomatous (1/14). As the pathogenesis of these polyps remains unclear, we propose to replace the term inflammatory tonsillar polyp by a morphological diagnosis based on the stromal characteristics of the lesions. Simple surgical excision was curative in the 9 cases with available follow-up information.

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Benign tonsillar polyps in humans beings are mostly considered hamartomatous growths containing vascular, connective, lymphoid and fat tissue in variable proportions.[7,8,12] As in dogs, human tonsillar polyps are infrequent but the real incidence is unknown.[7,12] Histologically, polyps are recommended to be classified according to the most prominent stromal component and, in contrast to dogs, different histotypes have been reported as including lymphangiomatous, lymphangiectatic, and fibrous or fibrolipomatous, lymphoid, fibroepithelial, among others, have been reported.[2,7,12,17]

The objective of this report is to describe the clinicopathological characteristics of 14 tonsillar polyps in dogs, review their classification, and compare the canine lesion to known pathogenesis in humans.

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Clinical ~~data~~ and macroscopic data ~~features of individual cases~~ are shown in Table 1. Age of the dogs ranged from 3 to 13 years (mean 9.3). Females (10/14) were more affected than males (4/14). All patients presented with a unilateral, variably ~~e~~-sized polyp emerging from the surface of palatine tonsil. Polyps were located on the right (6/14), left (4/14), or unreported (4/14). Most dogs were asymptomatic; ~~.~~ ~~O~~only 4/12 (33%) cases showed clinical signs consisting of mouth bleeding (case 7), cough (case 10), retching (case 10,14) and dyspnea (case 13). Follow-up information was available in 9/14 (64%) cases, none of which showed local recurrence after simple surgical excision.

Nine of 14 (67%) polyps were pedunculated and 5/14 (36%) were sessile. The total length of the polyps ranged from 1 cm to 3.8 cm (mean, 1.93 cm) and the diameter from 0.3 to 1.4 cm (mean, 0.69 cm). Polyps showed a smooth (12/14), papillary (1/14) or verrucous (1/14) surface. Cut section was white to yellow and varied from soft and spongy (9/14) to firm and fibrous (4/14) to gelatinous~~.~~ ~~In~~ (1/14). ~~case (case 14) a gelatinous appearance was noted.~~

Polyps were categorized into different histological subtypes according to the main constituents of their stroma. Histologic characteristics of each case are shown in Supplemental Table S1.

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Commented [JLC3]: Table 1. Instead of revision (3 uses), I suggest "examination" or "checkup".

Commented [JM4R4]: The term revision has been replaced by examination in the R2 version of Table 1.

Seven of 14 polyps (57%) were diagnosed as lymphangiomatous. Lesions showed a highly vascularized stroma with abundant dilated endothelial-lined cavities and interconnected vascular channels, compatible~~s~~ with lymphatic vessels (Figs. 1, 2). Lymphatics were empty or filled by eosinophilic fluid, and were separated by hypocellular, dense fibrovascular tissue occupying <50% of the stroma (Fig. 2). In 2/14 lesions, 25-50% of the stroma was infiltrated by adipose tissue and were subclassified as lymphangiolipomatous (Supplemental Fig. S1). Expanded subepithelial lymphoid follicles were multifocally present (Supplemental Fig. S2). Polyps were covered by stratified squamous epithelium with mild to moderate irregular hyperplasia (Supplemental Figs. S2-S4). Multifocally, the stroma elevated the surface forming small nodular projections and, in one case, causing a verrucous appearance (Supplemental Fig. S4). Acute necrotic changes including fibrinoid necrosis of blood vessel walls and intravascular fibrin thrombi were rarely seen (case 1~~;~~) ~~(~~Supplemental Fig. S5), without associated clinical signs.

Four of 14 cases (29%) showed a predominantly fibrous stroma with numerous, slightly-dilated and non-anastomosing vessels. In 2 of the 4~~/4 polyps~~, lymphatics predominate~~d~~ and were categorized as lymphangiofibromatous (Supplemental Fig. S6). The ~~remaining~~ other 2 of these ~~/~~4 polyps showed a predominance of blood vessels and were classified as angiofibromatous (1/4) or angiofibrolipomatous (1/4)~~, if~~ based on adipose tissue occupying more than ~~>~~25% of the stroma ~~was infiltrated by adipose tissue~~ (Figs. 3, 4).

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Canine and human tonsillar polyps can present as pedunculated or sessile masses with smooth or papillary surface.[3,7,8,11-13] Canine tonsillar polyps in this series were mostly pedunculated with smooth surface. This contrast with observations from the previously reported case series in which only 3/8 polyps were pedunculated.[11]

As in humans, the stroma of canine tonsillar polyps is was composed by variable proportions of lymphatic and blood vessels, fibrous tissue, lymphoid tissue, and occasionally fat tissue, leading to different histomorphology that justify allow their classification into different histological subtypes.[2,7,8,12]

Lymphangiomatous polyps were the most common histological subtype in this case series. They show identical features to those previously reported in an adult dog and in peoplehumans.[7,13] These type of polyps have also been referred as tonsillar lymphangiomas by human pathologists.[12] However, tonsillar lymphangiomatous polyps show have not as largesmaller lymphatic spaces and more fibrous and lymphoid stromal elements than lymphangiomas found elsewhere.[12] Canine lymphangiomas usually affect the skin of young dogs, and involvement of internal tissues is very rare and mostly associated to a lymphangiomatosis syndrome with systemic involvement.[16]

The histomorphology of angiofibromatous polyps in our series is similar to those described by Lucke et al[11] as canine tonsillar inflammatory polyps, and to the stroma of canine and feline nasopharyngeal and middle ear polyps.[9,15] In contrast to tonsillar polyps, nasopharyngeal and middle ear polyps ~~these~~ are usually partially covered by pseudostratified ciliated columnar epithelium and the stromal core and peduncle are less vascularized.[9,15] The main differential diagnosis considered for angiofibromatous and angiofibrolipomatous polyps was angiofibroma. Due to the lack of infiltrative growth, the stromal fat infiltration, and the lower cellularity in these polyps when compared to canine nasal angiofibromas, this diagnosis was excluded.[4]

One polyp was classified as myxomatous. To the best of our knowledge, such histological appearance has not been described in human or canine tonsillar polyps. The highly edematous appearance of this polyp might be secondary to inflammation, as suggested for similar stromal changes in nasopharyngeal and laryngeal canine and feline polyps.[9,18,19]

The pathogenesis of benign tonsillar polyps is unclear. While an inflammatory origin has been suggested for canine lesions, the most accepted theory in human pathology ~~defends~~ considers these polyps ~~to be considered~~ as hamartomas.[2,7,8,11,12,20] This is further supported by the evidence of a disorganized ~~pattern of~~ distribution of fibronectin and collagens I and III within the stroma of tonsillar polyps regardless of their histomorphology.[1] Therefore, tonsillar hamartomas could present a variable histologic spectrum including polyps with fibrous/fibrovascular, lymphangiomatous, lymphoid and/or, more rarely, lipomatous appearances.[2,7,8,12] A second theory involves chronic inflammatory hyperplasia with irreversible lymphatic obstruction and

lymphangiectasia, eventually causing mucosal prolapse and formation of a polyp.[8,12] Evidence against this explanation is that chronic tonsillitis occurs more commonly than polyps, and many patients with polyps lack a history of tonsillitis.[7,8,12] ~~None of our cases or those previously reported presented with~~ A clinical history of previous episodes of tonsillitis was not indicated in any of our cases or those previously reported.[3,11,13] Partial polyp torsion with subsequent lymphangiectasia and acute inflammatory and necrotic changes is possible in lesions with a long peduncle, as observed in our series (case 1).

As in humans ~~beings~~, the pathogenesis of canine tonsillar polyps may involve a multistep process with an initial hamartomatous growth followed by secondary inflammatory and degenerative changes.[1,12]

Secondary chronic inflammation in human tonsillar polyps causes stromal remodeling and lymphoid hyperplasia, occasionally producing lymphoid polyps.[1,2,12] These are characterized by a stroma composed predominantly of lymphoid tissue (>80%) organized in follicles around a fibrovascular core, similar to that observed in cases 12 and 13.[1,2] To the best of our knowledge, tonsillar lymphoid polyps have not been previously described in veterinary medicine.

Fat tissue was present in 4 of the lesions and, when occupying >25% of the stroma, the term lipomatous was added to the morphological diagnosis. Adipose tissue infiltration within some polyps probably reflects chronic degenerative and metaplastic stromal changes.[7,10,14]

In conclusion, canine tonsillar polyps are benign unilateral and usually asymptomatic lesions of adult dogs, with excellent response to surgical

resection. They are composed ~~by~~ of lymphatics, blood vessels, fibrous, lymphoid and fat tissue in variable proportions, producing different histomorphology. As in humans, a~~n~~ hamartomatous origin with superimposed inflammatory changes ~~should~~ may be considered ~~regarding the pathogenesis~~. We propose replacing the term inflammatory tonsillar polyp ~~to be replaced by~~with morphological diagnoses based on the stromal characteristics.

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Figure legends

Figures 1-4. Polyps, tonsil, dog. **Figures 1-2.** Lymphangiomatous polyp, case No. 1. **Figure 1.** Pedunculated polyp ~~with a stroma~~ with numerous dilated vascular cavities in the stroma. Large aggregates of lymphocytes are within the subepithelial space. Hematoxylin and eosin (HE). **Figure 2.** Dilated lymphatic vessels with occasional valves ~~on~~ are present amid scantr~~ce~~ fibrous stroma. HE. **Figures 3-4**. Angiofibrolipomatous polyp, case No 8. Sessile polyp with abundant fibrous stroma that multifocally ~~infiltrated by~~contains adipose tissue. ~~and n~~Numerous congested~~ive~~ blood vessels are concentrated ~~at~~ in the stromal core. HE.

Figures 5-9. Polyps, tonsil, dog. **Figures 5-6.** Lymphoid polyp, case No. 13. **Figure 5.** Sessile polyp with stroma composed of large hyperplastic lymphoid follicles surrounding a fibrovascular core. Inset: the polyp is covered by stratified epithelium and tonsillar reticular epithelium transmigrated by lymphocytes. HE. **Figure 6.** Secondary antigen-polarized lymphoid follicles with expanded germinal centers surrounded by a thin mantle zone. Inset: germinal centers contain tingible~~-~~-body macrophages. HE. **Figures 7-9.** Myxomatous polyp, case No. 14. **Figure 7.** Pedunculated polyp with severely edematous stroma and a fibrovascular pedicle. A transition line between ~~both~~ the two areas is seen (arrowheads). Inset: Intraepithelial and subepithelial vesicles containing edema. HE. **Figure 8.** Edematous stroma contains small numbers of spindle cells and mild multifocal to diffuse mononuclear inflammatory infiltrates. HE. ~~Inset: Intraepithelial and subepithelial vesicles containing edema.~~ **Figure 9.**

303 Fibrovascular pedicle with numerous congested~~ive~~ blood vessels and empty
304 lymphatic vessels at the base. HE.

Table 1. Clinical and macroscopic characteristics of canine tonsillar polyps

Case	Breed	Age	Sex	Type of polyp	Clinical signs	Side	Macroscopic appearance [a]	Outcome
1	Poodle	13 y	F	Lymphangiomatous	Incidental finding during intubation (n/s surgery)	R	2,8 x 1,4-0,45 cm, pedunculated, smooth surface	No recurrence nsd
2	Yorkshire Terrier	7 y	M	Lymphangiomatous	Incidental finding during annual examination	L	1 x 0,3 cm, pedunculated, smooth surface	No recurrence nsd
3	Catalan Sheepdog	11 y	F	Lymphangiolipomatous	Incidental finding n/s reason	R	1,4 x 0,8-0,6 cm, sessile, smooth surface	No recurrence after 7 mo; death by unrelated causes
4	Scottish Terrier	10 y	F	Lymphangiomatous	Unknown	n/s	1,2 x0,3-0,1, pedunculated, smooth surface	Unknown
5	Mongrel	10 y	M	Lymphangiomatous	Incidental finding during annual examination	R	2,4 x 0,4 cm, pedunculated, smooth surface	No recurrence 3 mo.; missing after that
6	Mongrel	9 y	F	Lymphangiolipomatous	Unknown	L	2,4x 1,1- 0,4 cm, pedunculated, smooth surface	Unknown
7	Fox Terrier	11 y	M	Lymphangiomatous	Recurrent episodes of oral bleeding	n/s	1,4 x 0,8-0,3 cm, pedunculated, verrucous surface	Unknown
8	Maltese	12 y	F	Angiofibrolipomatous	Incidental finding during intubation (dental cleaning)	R	3 x 1 cm., sessile, smooth surface	No recurrence after 8 mo.; no more follow-up
9	Labrador Retriever	3 y	F	Lymphangiofibromatous	Incidental finding during intubation (n/s surgery)	L	1,6 x 1, sessile with smooth surface	Unknown
10	Barbone	13 y	F	Angiofibromatous	Cough, retching	L	1 x 0,4-0,2 cm, pedunculated, papillary surface	No recurrence after 2 mo.; no more follow-up
11	Miniature Schnauzer	9 y	F	Lymphangiofibromatous	Incidental finding during annual examination	n/s	1,5 x 0,5-0,2 cm, pedunculated, smooth surface	No recurrence
12	Mongrel	7 y	F	Lymphoid	Incidental finding n/s reason	R	1,5 x 0,6 cm, sessile, smooth surface	No recurrence after 2 y; death by unrelated causes
13	Mongrel	7 y	F	Lymphoid	Progressive dyspnea 3 mo.	n/s	1,3 x 0,5 sessile, smooth surface	Unknown
14	Mongrel	8 y	M	Myxomatous	Retching	R	2,1 x 0,9-0,5 cm, pedunculated, smooth surface	No recurrence nsd

[a] Measures are expressed as total length of the polyp x diameter of the polyp – diameter of the pedicle. Abbreviations: M, male; F, female; R, right; L, left; n/s, not specified; n/a, not applicable; nsd, not specified duration.

Table 1. Clinical and macroscopic characteristics of canine tonsillar polyps

Case	Breed	Age	Sex	Type of polyp	Clinical signs	Side	Macroscopic appearance [a]	Outcome
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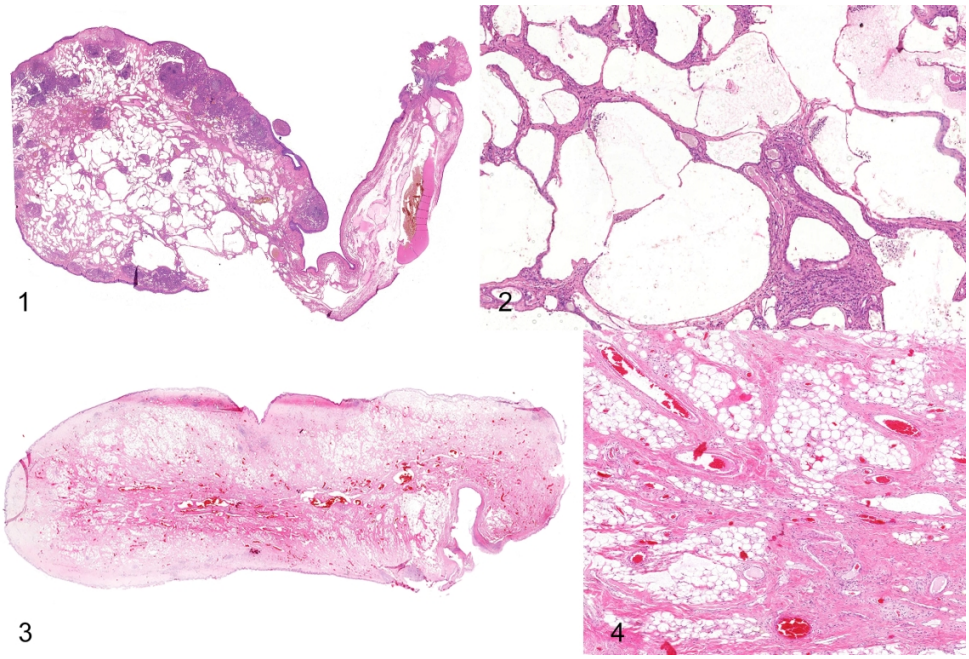
2	Yorkshire Terrier	7 y	M	Lymphangiomatous	Incidental finding during annual ~~revision~~examination	L	1 x 0,3 cm, pedunculated, smooth surface	No recurrence nsd
3	Catalan Sheepdog	11 y	F	Lymphangiolipomatous	Incidental finding n/s reason	R	1,4 x 0,8-0,6 cm, sessile, smooth surface	No recurrence after 7 mo; death by unrelated causes
4	Scottish Terrier	10 y	F	Lymphangiomatous	Unknown	n/s	1,2 x0,3-0,1, pedunculated, smooth surface	Unknown
5	Mongrel	10 y	M	Lymphangiomatous	Incidental finding during annual ~~revision~~examination	R	2,4 x 0,4 cm, pedunculated, smooth surface	No recurrence 3 mo.; missing after that
6	Mongrel	9 y	F	Lymphangiolipomatous	Unknown	L	2,4x 1,1- 0,4 cm, pedunculated, smooth surface	Unknown
7	Fox Terrier	11 y	M	Lymphangiomatous	Recurrent episodes of oral bleeding	n/s	1,4 x 0,8-0,3 cm, pedunculated, verrucous surface	Unknown
8	Maltese	12 y	F	Angiofibrolipomatous	Incidental finding during intubation (dental cleaning)	R	3 x 1 cm., sessile, smooth surface	No recurrence after 8 mo.; no more follow-up
9	Labrador Retriever	3 y	F	Lymphangiofibromatous	Incidental finding during intubation (n/s surgery)	L	1,6 x 1, sessile with smooth surface	Unknown
10	Barbone	13 y	F	Angiofibromatous	Cough, retching	L	1 x 0,4-0,2 cm, pedunculated, papillary surface	No recurrence after 2 mo.; no more follow-up
11	Miniature Schnauzer	9 y	F	Lymphangiofibromatous	Incidental finding during annual ~~revision~~examination	n/s	1,5 x 0,5-0,2 cm, pedunculated, smooth surface	No recurrence
12	Mongrel	7 y	F	Lymphoid	Incidental finding n/s reason	R	1,5 x 0,6 cm, sessile, smooth surface	No recurrence after 2 y; death by unrelated causes
13	Mongrel	7 y	F	Lymphoid	Progressive dyspnea 3 mo.	n/s	1,3 x 0,5 sessile, smooth surface	Unknown
14	Mongrel	8 y	M	Myxomatous	Retching	R	2,1 x 0,9-0,5 cm, pedunculated, smooth surface	No recurrence nsd

[a] Measures are expressed as total length of the polyp x diameter of the polyp – diameter of the pedicle. Abbreviations: M, male; F, female; R, right; L, left; n/s, not specified; n/a, not applicable; nsd, not specified duration.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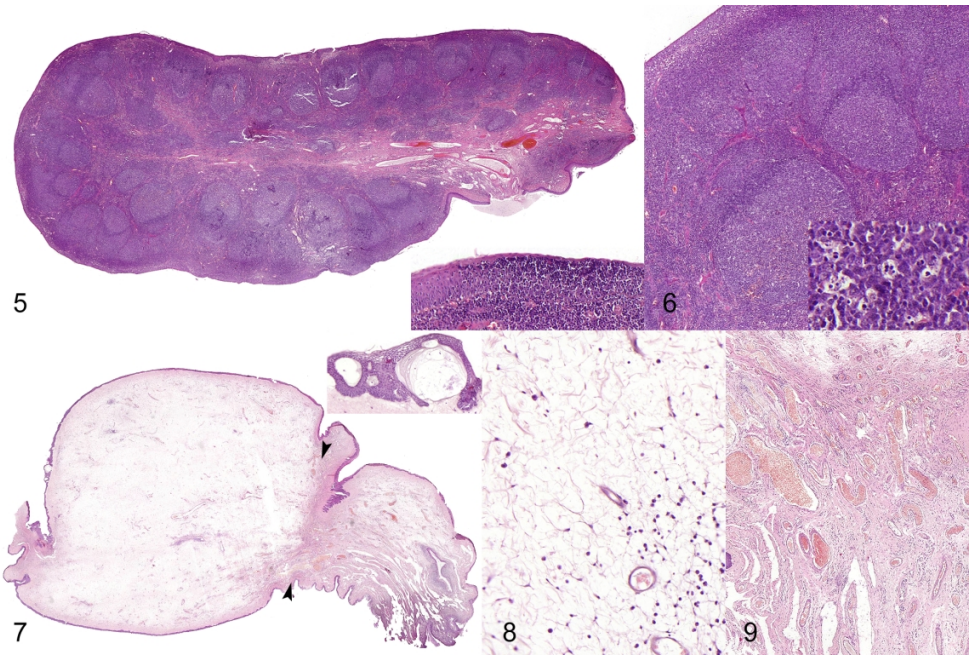
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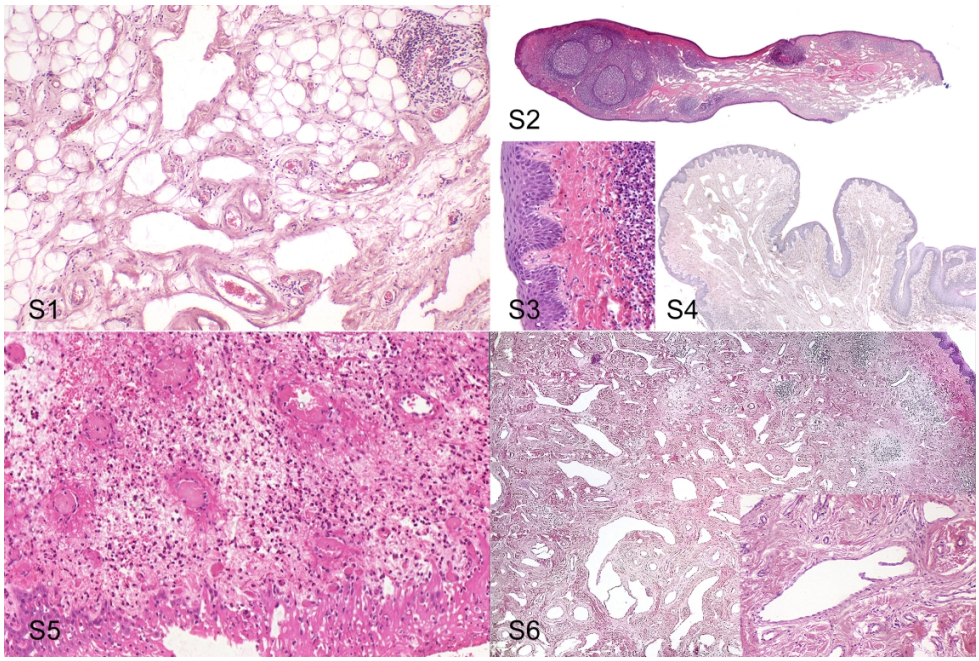
Supplemental Table 1. Histologic characteristics of canine tonsillar polyps

Case	Vessel density	Vessel type	Vascular spaces	Fibrous tissue	Fat	Lymphoid tissue	Edema	Inflammation			Diagnosis
								Degree	Distribution	Cells	
1	3	lymphatic >> blood	4	1	0	1	1	2	MF	L, P, N	Lymphangiomatous
2	3	lymphatic >> blood	3	1	0	2	0	1,5	MF to D	L, P	Lymphangiomatous
3	3	lymphatic >> blood	3	1	2	1	2	1,5	MF	L, P > N	Lymphangiolipomatous
4	3	lymphatic >> blood	3	2	0	1	1	1,5	MF	L, P	Lymphangiomatous
5	3	lymphatic >> blood	4	1	0	1	1	1,5	MF	L, P	Lymphangiomatous
6	3	lymphatic >> blood	3	1	2	0	1	1,5	MF	L, P	Lymphangiolipomatous
7	3	lymphatic >> blood	3	2	0	1	1	1,5	MF	L, P	Lymphangiomatous
8	2	blood > lymphatic	1	3	2	0	1	1,5	MF	L, P	Angiofibrolipomatous
9	3	lymphatic > blood	2	3	0	0	1	2	MF to D	L, P	Lymphangiofibromatous
10	2	blood > lymphatic	1	3	1	1	0	1	MF	L, P	Angiofibromatous
11	2	Lymphatic > blood	2	3	0	1	0	2	MF	L, P	Lymphangiofibromatous
12	2	lymphatics & blood	1	1	0	4	0	2	D	L, P	Lymphoid
13	1	lymphatics & blood	1	1	0	4	2	1	D	L, P	Lymphoid
14	2	blood > lymphatic	2	3	0	0	3	1	MF to D	L, P > N, H	Myxomatous

Abbreviations: D, diffuse; H, histiocytes; L, lymphocytes; MF, multifocal; N, neutrophils; P, plasma cells. Vascularization, edema, and degree of inflammation were graded on a 0–3 scale (0, absent; 1, mild; 2, moderate; 3, marked). Vascular spaces, lymphoid, fibrous and fat tissue were graded on a 0–4 scale based on percent (0, absent; 1, 1–25%; 2, 26–50%; 3, 51-75%; 4 >75% stroma).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Supplemental Figures S1-6. Polyps, tonsil, dog. **Figure S1.** Lymphangiolipomatous polyp, case No. 6. The stroma is severely infiltrated by adipose tissue with empty dilated lymphatic vessels, few blood vessels and multifocal small lymphoplasmacytic aggregates. HE. **Figures S2, S3**. Lymphangiomatous polyp, case No. 2. **Figure S2.** Pedunculate polyp with fibrovascular pedicle and subepithelial lymphoid hyperplasia. Secondary hyperplastic follicles show expanded germinal centers surrounded by a thin mantle zone and antigen-related polarity. HE. **Figure S3.** Polyp covered by irregular hyperplastic stratified epithelium separated from the stromal core by a band of fibrous tissue. HE. **Figure S4.** Lymphangiomatous polyp, case 7. The surface is multifocally elevated producing a verrucous appearance. HE. **Figure S5.** Lymphangiomatous polyp, case 1. Acute necrosis at the base of the polyp with fibrinoid necrosis of blood vessel walls. HE**. Figure S6.** Lymphangiofibromatous polyp, case No. 9. The stroma shows abundant fibrous tissue with numerous lymphatic vessels. There are multifocal aggregates of inflammatory cells. Inset: detail of lymphatic vessels with valves, lined by flattened endothelium. HE