VI

INTERNATIONAL CONGRESS OF VETERINARY NURSING

25 | 26 | October | 2019

POLYTECHNIC OF VISEU

Papers in Conference Proceedings

Canine hair follicular tumours: a retrospective study

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Abstract

Hair follicular tumours in dog comprise a large and heterogeneous group of neoplasms that display morphological features resembling one or several portions of the normal hair follicle which constitute a huge effort for its diagnosis.

Histopathological evaluation is required to better characterize the different types of canine hair follicular tumours, in order to better understand its biological behaviour and to collaborate with the daily clinical practice.

Thus, a retrospective, cross-sectional descriptive study was carried out with goal of analyse its frequency and characteristics, in order to contribute to a better understanding of this vast group of tumours.

As main results the authors verified a higher incidence of follicular tumours in male dogs, being the most frequent types diagnosed trichoepithelioma, followed by, trichoblastoma, infundibular keratinizing acanthoma and pilomatricoma and the average age of dogs was 8.76 years. Also, malignant tumours represented 31.6% of all canine hair follicular tumours diagnosed (n= 114).

Key words: canine, dog, hair follicular tumours, histopathology, trichoepithelioma, trichoblastoma, infundibular keratinizing acanthoma (IKA) and pilomatricoma

Introduction

The normal hair follicle are generally divided into three parts which include *infundibulum*, from the epidermis to the sebaceous duct region, *isthmus* from the sebaceous duct to the arrector pili muscles insertion and *inferior segment*

from the arrector pili muscle insertion to the bulb (Goldschmidt & Goldschmidt, 2017).

Each of these regions has differentiating histological characteristics and produce different types of keratin that are the basis for the growth of neoplasms of different origin: infundibular, isthmic or bulbar (Adedeji *et al.*, 2017; Goldschmidt & Goldschmidt, 2017).

Thus canine hair follicular tumours comprise a large and heterogeneous group of neoplasms that display morphological features resembling one or several portions of the normal hair follicle or recapitulate part of its embryological development (Mineshige *et al.*, 2014; Tellechea *et al.*, 2015) whose characteristics are generally described within parameters of large-scale. So it is still a huge effort of histopathological diagnosis to better identify these entities, collaborating with the daily clinical practice (Kok *et al.*, 2017; Adedeji *et al.*, 2017).

It is well known that the clinical and macroscopic aspects do not allow any inference about biological behaviour of any neoplasia type, in the same way regarding follicular neoplasms, until the histopathological evaluation is provided, the biological behaviour of the excised neoplasm is completed unknown (Goldschmidt & Goldschmidt, 2017).

The most common types of hair follicular neoplasms are summarized in table 1.

Thus, if most of the hair follicular tumours are benign and complete surgical excision are curative, two of them, trichoepithelioma and pilomatricoma, could have malignant behaviour and possibility of metastasizing (Goldschmidt & Goldschmidt, 2017), requiring full attention to ensure that their histopathological diagnosis is accurate, despite the histogenic similarities with their benign counterparts and the other hair follicular neoplasms subtypes.

Table 1. Canine hair follicular neoplasms

Benign	Malignant
Infundibular keratinizing acanthoma	
Tricholemmoma	
Trichoblastoma	
Trichofolliculoma	
Trichoepithelioma	Malignant trichoepithelioma
Pilomatricoma	Malignant pilomatricoma

Adapted to Goldschmidt & Goldschmidt (2017).

Objectives

This study aimed to analyse the frequency of canine follicular tumours and to study their spectrum and characteristics, based on a retrospective analysis of diagnostic tests performed in the Laboratory of Veterinary Pathological Anatomy from Agrarian School of Viseu (LVPA-ESAV).

Material and Methods

One hundred fourteen samples of canine cutaneous neoplasms from veterinary care centres, were presented to the LVPA-ESAV for complementary diagnostic purposes.

Most samples were obtained by surgical excision, immediately fixed in 10% buffered formalin solution, embedded in paraffin wax and 3 μm thick sections were stained for routine histopathological diagnosis with Haematoxylin and Eosin (HE).

A retrospective, cross-sectional descriptive study was carried out, from 2006 to August 2019.

The dog breeds were grouped according to size in 7 groups: tiny, small, midsize, medium size, large and giant. In order to facilitate the statistical analysis, crossbred dogs of unknown or unidentified breed were grouped as "undefined". The group allocation was based on the information available in the diagnostic records provided by the veterinarian responsible for sample submission.

For each type of neoplasia, a frequency analysis was performed, presented through tables and graphs. For their association with qualitative variables we

used the Binomial and Chi-square tests. A significance level of 0.05 was considered and the statistical software SPSS v.25 was used.

Results and discussion

The LVPA-ESAV from 2006 to August 2019 recorded a total of 114 histopathological analysis, corresponding to confirmed follicular tumours (Table 2) in 80 dogs, of which 26 were diagnosed with more than one follicular tumour type and 18.4% had two histologically different follicular tumours and 4.4% three different ones.

Of the 80 dogs studied, 29 (36.3%) were female and 51 (63.7%) male, e.g. a male: female ratio of 1.76. However, female dogs presented more multiple follicular tumours than males (25.6% vs 23.9%), with significant differences between females and males. Males presented higher incidence of follicular tumours (p=0.019).

From 2012 to 2019, the age range of dogs ranged from 1 year to 15 years and 10 months, with an average age of 8.76 ± 3.35 years.

Regarding the number total of follicular tumours diagnosed (n=114), the most frequent were trichoepithelioma (42.1%), trichoblastoma (24.6%), infundibular keratinizing acanthoma (IKA) (14.0%) and pilomatricoma (13.2%) (Figure 1).

The incidence of benign and malignant neoplasms was 68.4% and 31.6%, respectively. Significant differences were found between the type of follicular tumour developed and the biological behaviour (benign or malignant) (Qui^2(30)=42.726; p<0.001) (Table 2), verifying a higher incidence of the benign tumours IKA and trichoblastoma (35.9% and 25.6%, respectively of benign) and malignant trichoepithelioma (77,8% of malignant).

Dogs of unidentified breeds were the most affected by hair follicular tumours (37.7%, 22 females and 21 males), followed by large breed dogs (29.8%, 20 females and 16 males). Significant differences were found between the number of follicular tumours associated with each dog size/breed group (Qui^2(6)=58.555; p=0.010) (Table 2), as well as between dog/breed and dog gender (Qui^2(6)=14.695; p=0.016).

Although there are no significant differences between the development of benign and malignant follicular tumours and the type of dog breed/size

(Qui^2(6)=8.147; p=0.226), a slightly higher than expected incidence of malignant tumours in dogs of undefined breed (52.8% of malignant tumours) was verified.

Table 2. Characterization of canine hair follicular neoplasms diagnosed during the period from 2006 to August 2019 according to sex, behaviour and size.

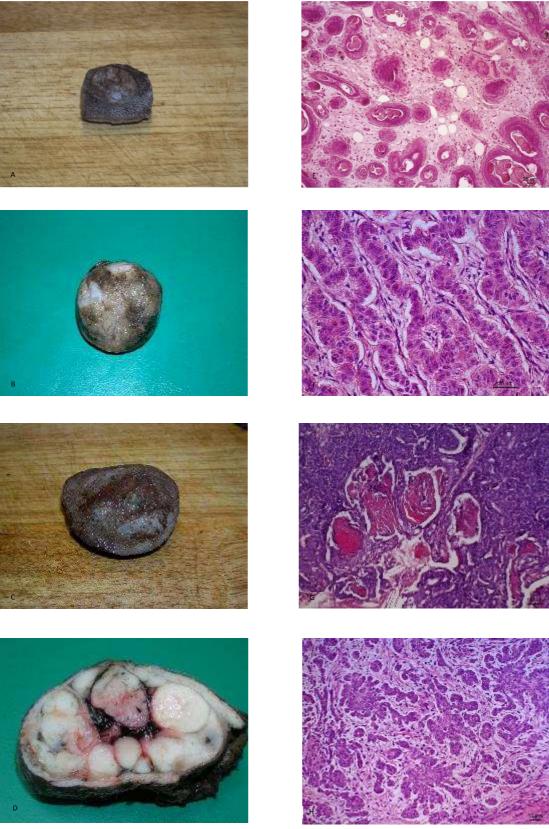|	Follicular tumour						p-value
	Infundibular Keratinizing Acanthoma	Pilomatri-coma	Trichoblas-toma	Trichoepithe-lioma	Trichofolli-culoma	Tricholem-moma	0,017
N (%)	16 (14%)	15 (13.2%)	28 (24.6%)	48 (42.1%)	3 (2.6%)	4 (3.5%)	**<0.001**
Genre (Female/Male)	7 / 9	5 / 10	8 / 20	21 / 27	1 / 2	1 / 3	**0.814**
Behavior (Benign/Malignant)	16 / 0	7 / 8	28 / 0	20 / 28	3 / 0	4 / 0	**<0.001**
Size							**0.010**
Tiny dog	2	0	2	1	2	0	
Small dog	0	0	2	0	0	0	
Midsize dog	0	0	2	0	0	1	
Medium size dog	1	5	5	7	0	0	
Large dog	9	6	6	12	0	1	
Giant dog	0	1	3	3	0	0	
Not defined	4	3	8	25	1	2	

Fig. 1. Macroscopic aspect of follicular tumours (A, B, C and D). Trichoepithelioma benign (A) and malignant (C). Trichoblastoma (B and D). Microscopic aspect of follicular tumours (E, F, G and H). Trichoepithelioma benign (E) and malignant (G). Trichoblastoma cordonal type (F) and medusoidal type (H).

Conclusion

Taking into account the scarce number of studies regarding the specific incidence of follicular tumours, once most of the studies consulted described parameters of large-scale and only a qualitative characterization of incidence with no exact expressions, such as "uncommon", "rare" or "frequent", the results obtained in the present work contribute to the better characterization of these tumours.

Therefore the author's intent to alert the animal health team to the risk of dogs of all ages might develop these tumours, being at increased risk the male dogs over 8 years old, cross breed or large.

Although most of these tumours are described as having benign behaviour, in the present study an unexpectedly high percentage of malignant tumours (31.6%) justifies a closer monitoring of it, reinforcing the need for early diagnosis for timely and effective surgical excision.

Acknowledgments

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