

SKIN TUMORS IN DOGS - A RETROSPECTIVE STUDY OF TEN YEARS

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ABSTRACT

In this study 662 skin tumors from 644 dogs were used, originated from regions of the State of São Paulo, Brazil, between January 1998 and January 2008. The samples were obtained from necropsies (1,66%) and surgical excision (98,33 %) and processed in Department of Veterinary Pathology at the School of Agrarian and Veterinary Sciences of Jaboticabal, São Paulo, Brazil. Twenty-three different types of tumors in the skin and subcutaneous tissue were diagnosed with some animals affected (1,70%) by more than one morphological type. The soft tissue sarcoma tumors were categorized into eight different histological types. These tumors presented the greatest occurrence (53,92%) followed by epithelial tumors (10 types; 33,08%), melanocytic tumors (two type; 6,64%) and lymphocytic tumors (tree types; 6,34%). Mast cell tumors, cutaneous histiocytoma, squamous cell carcinoma, fibrosarcoma and melanocytoma were the most common tumors, accounting for just over 50% of all the skin tumors. From the samples studied 53,27% were from females and 46,73% from males; 72,81% of the dogs were pure bred, while 27,19% were mixed-breed. The malignant tumors (59,51%) were more frequent than the benign tumors (40,49%). The occurrences of epithelial, soft tissue sarcoma and melanocytic tumors were statistically greater among dogs aged six to eleven years. Lymphocytic tumors were more frequent among animals less than three to eight years old. These results are important for small animal clinical practices. They serve as a further tool to direct the diagnosing of skin tumors in dogs as rapidly and precisely as possible.

Keywords: skin tumors, histopathology, biopsy, dog.

INTRODUCTION

Skin and subcutaneous tumors are some of the types of neoplasia that most affect dogs worldwide (PULLEY; STANNARD, 1990), representing approximately 30% of all the types of tumors reported in this species (PRIESTER; MANTEL, 1971; BOSTOCK, 1986). In a study conducted in 17 veterinary hospitals in the United States, skin tumors were the second most frequently diagnosed type of dermatological abnormality, while hypersensitivity to flea bites was the first in the ranking (SISCHO et al., 1989). The high incidence of these tumors can be explained by the continual exposure of the tegument to a wide variety of chemical and physical abuse (HUEPER, 1963; HARGIS et al., 1992). Because surgical access to them is easily achieved, they are more frequently removed than are tumors in other organs (DORN et al., 1966; WEISS, 1974).

Analysis of the histological characteristics, together with the information coming from systematic clinical examination, supplies essential data for establishing the prognosis and therapy to be used. Histological characteristics such as morphology, nuclear grade, tumor growth pattern and rate, tissue invasion, histological grade and metastasis development make it possible to predict the biological behavior of neoplasia. Thus, these constitute important prognostic factors and are a source of information for clinicians who intend to institute courses of treatment for animals (PIRES et al., 2003).

The occurrence of different types of skin tumors in canines has been described in several studies (BRODEY, 1970; MACVEAN et al., 1978; FINNIE; BOSTOCK, 1979; LADDS et al., 1983; BOSTOCK, 1986; ROTHWELL et al., 1987; ER;

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SUTTON, 1989; GOLDSCHMIDT; SHOFER, 1992; KALDRYMIDOU et al., 2002, PIRES et al., 2003, SOUZA et al., 2006, PAKHRIN et al., 2007). However, in Brazil, studies on the occurrence of these types of tumor are rare, particularly in relation to sex, breed and age (SOUZA et al., 2006).

This article had the aims of providing data relating the occurrence of various types of skin tumor and investigating the relationships between such occurrences and sex, breed and age, among a set of 662 skin tumor samples examined over a ten-year period, coming from a defined population of dogs in the northern and northeastern regions of the State of São Paulo, Brazil.

MATERIAL AND METHODS

The case population included 662 samples of skin tumors originating from various cities in the northern and northeastern regions of the State of São Paulo, Brazil. Medical records of dogs evaluated at the Department of Veterinary Pathology at the School of Agrarian and Veterinary Sciences of Jaboticabal, State of São Paulo, Brazil from January 1998 though January 2008 were retrospectively reviewed for epidemiology and histologic diagnosis of tumors localized at skin. Some additional cases (n = 79) were excluded from the study because the data relating to sex, breed and age of the dogs and to the diagnoses were incomplete. The samples evaluated were obtained from necropsies (11/662 = 1,66%) and surgical excision (651/662 = 98,33 %) of skin tumors. The histopathological examinations were performed under an optical microscope. The neoplasia was evaluated on the basis of the histological classifications of animal tumors published by the Armed Forces Institute of Pathology (AFIP) and by the World Health Organization (HENDRICK et al., 1998; GOLDSCHMIDT et al., 1998; VALLI et al., 2002).

The histologic classification of the skin tumors (epithelial, soft tissue sarcoma, lymphocytic and melanocytic) was investigated first. Furthermore, the five most common types of skin tumor were compared with the reports of such occurrences that

were found in the literature (BRODEY, 1970; MACVEAN et al., 1978; FINNIE; BOSTOCK, 1979; LADDS et al., 1983; BOSTOCK, 1986; ROTHWELL et al., 1987; ER; SUTTON, 1989; KALDRYMIDOU et al., 2002, PIRES et al., 2003, SOUZA et al., 2006, PAKHRIN et al., 2007).

Affected dogs and the influence of their respective sex, breed and age on frequency were determined. The age parameter was distributed into five age groups, defined as follows: less than three years old, three to five years old, six to eight years old, nine to eleven years old, and greater than eleven years old.

The frequencies of benign and malignant tumors were determined. For cellular changes: pleomorphism, anisocytosis anisonucleosis, prominent or multiple nucleoli, cytoplasmic changes, increase in the number of mitoses and presence of aberrant mitosis (MEUTEN, 2002).

For correlation of histologic classification and origin of the skin tumors related to sex, breed and age, the chi-squared test was used, in the SAS V8 system (Statistical Analysis System®). The calculations were adjusted to the significance level of 5% (P < 0,05).

RESULTS

Six hundred and thirty and three (95,61%) dogs had only one histologic type of tumor and eleven (5,39%) had two or more tumors of different histologic types characterizing 662 samples of cutaneous tumor of the 644 dogs. Twenty-three different types of skin tumors were diagnosed. The soft tissue sarcoma tumors (STS) were categorized into eight different histological types. These tumors presented the greatest occurrence (53,92%) followed by epithelial tumors (10 types; 33,08%), melanocytic tumors (two type; 6,64%) and lymphocytic tumors (tree types; 6,34%) (Table 1). Mast cell tumor, cutaneous histiocytoma, squamous cell carcinoma, fibrosarcoma and melanocytoma were the most common tumors, accounting for just over 50% of all the skin tumors diagnosed during the study period (Figures 1 e 2).

Table 1. Prevalence of the various types of cutaneous tumors in 662 tumors located in the skin of dogs diagnosed during the period from January 1998 to January 2008 from north and northeast regions of the state of São Paulo.

Tumor type	Number	(%)
<i>Epithelial Tumors (n=219)</i>		
Squamous cell carcinoma	57	26,02
Hepatoid gland carcinoma	34	15,52
Sebaceous adenoma	33	15,06
Basal cell tumor	26	11,87
Sebaceous carcinoma	25	11,41
Hepatoid gland adenoma	21	9,58
Sweat gland carcinoma	9	4,10
Papilloma	6	2,73
Trichoepithelioma	6	2,73
Ceruminous gland tumor	2	0,91
<i>Soft tissue sarcoma tumors (n=357)</i>		
Mast cell tumor	133	37,25
Cutaneous histiocytoma	58	16,24
Fibrosarcoma	42	11,76
Hemangioma	39	10,92
Hemangiosarcoma	37	10,36
Lipoma	25	7,00
Fibroma	19	5,32
Liposarcoma	4	1,12
<i>Lymphocytic tumors (n=42)</i>		
Cutaneous plasmacytoma	26	61,90
Transmissible venereal tumor	13	30,35
Cutaneous lymphoma	3	7,14
<i>Melanocytic tumors (n=44)</i>		
Melanocytoma	40	90,90
Malignant melanoma	4	9,09

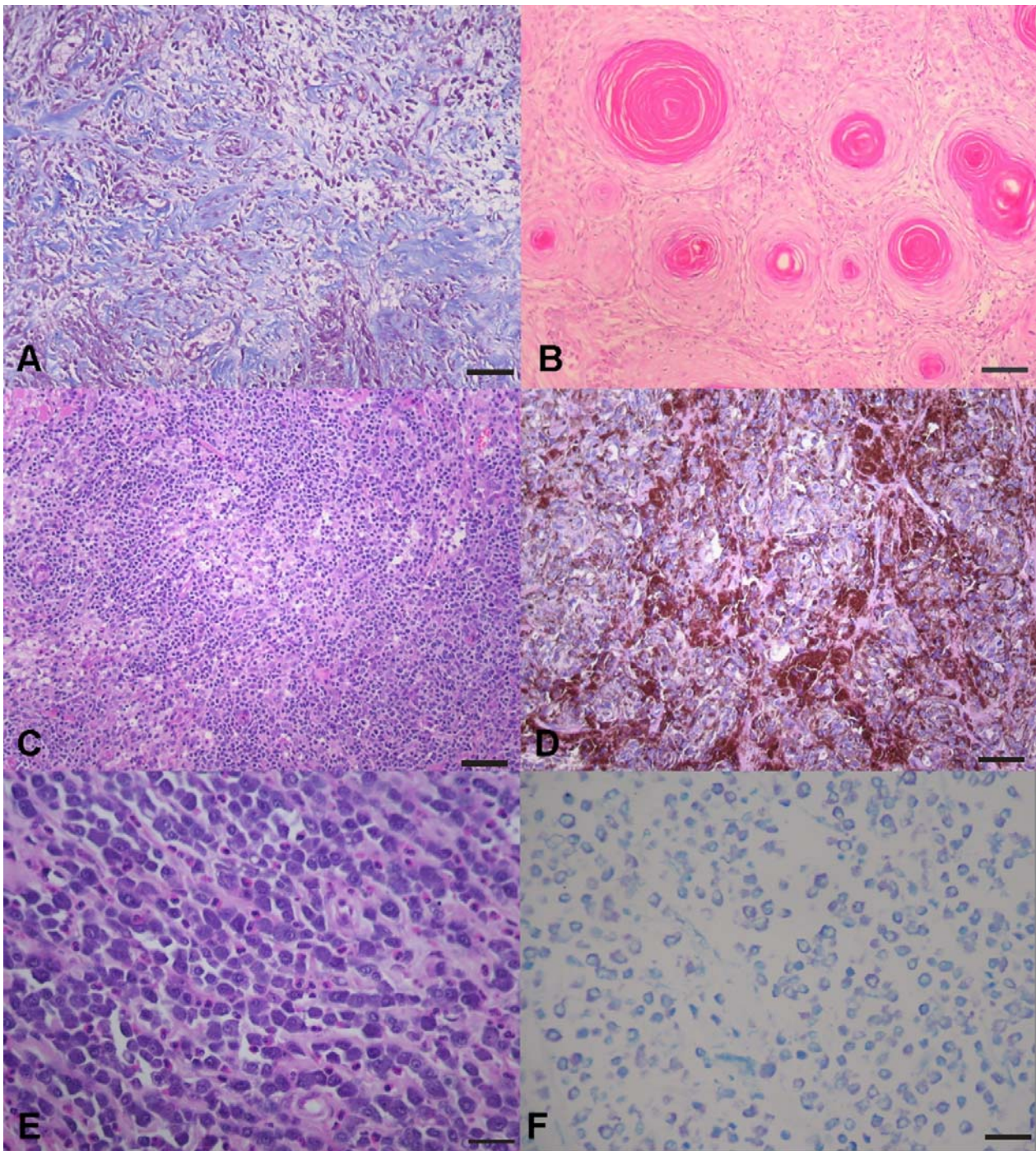


Figure 1. Photomicrograph of different cutaneous tumors in dogs (soft tissue sarcoma, epithelial, melanocytic and lymphocytic). (A) Fibrosarcoma. Presence of abundant collagen bundles. Masson's trichrome stain. bar = 25 μ m. (B) Squamous cell carcinoma. Presence of great amount of corneal pearls. H&E stain. bar = 25 μ m (C) Cutaneous histiocytoma. Note standard of monotonous cellular distribution and presence of bevelled cells. H&E stain. bar = 25 μ m (D) Melanocytoma. Presence of great amount of melanin pigments and diffuse distribution. H&E stain. bar = 25 μ m (E) Mast cell tumor. Note intense proliferation of mast cells. H&E stain. bar = 12,5 μ m (F) Mast cell tumor. Note granules of histamine in purple. Toluidine blue stain. bar = 20 μ m.

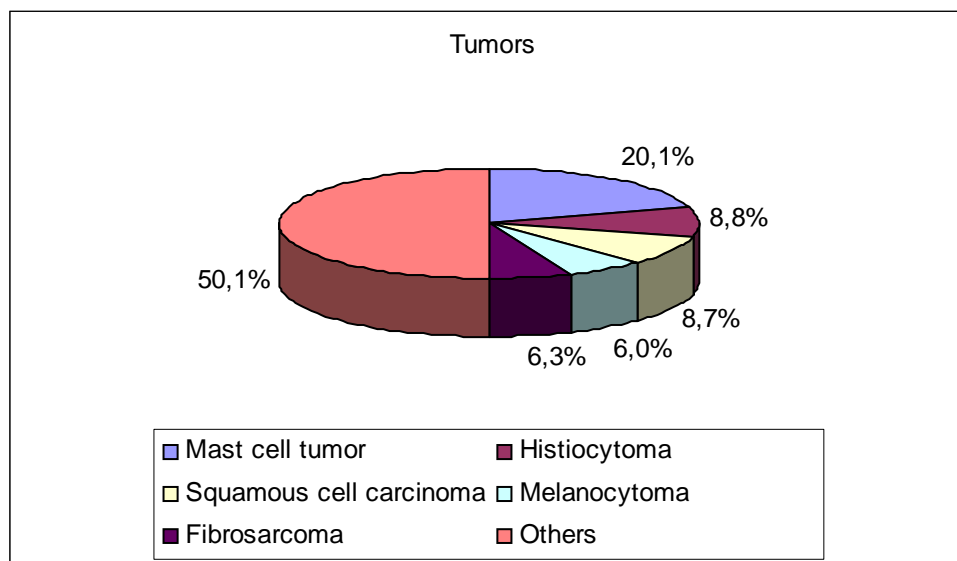


Figure 2. Percentage of the five most common cutaneous tumors diagnosed in this study

Four hundred and eighty two of the dogs (72,81%) were purebred, while 180 (27,19%) were mixed-breed. The purebred dogs belonged to 31 different breeds, among which boxers, poodles, alsatians and cocker spaniels were the breeds most

affected (Table 2). The ages presented the following percentage distribution: less than three years old (7,09%), three to five (15,25%), six to eight (30,96%), nine to eleven (29,30%) and greater than eleven (17,22%) (Table 3).

Table 2. Prevalence and breed distribution of cutaneous tumors during the period from January 1998 to January 2008.

Breeds Total(662)	Tumors				
	Epithelial (219)	Soft tissue sarcoma (357)	Lymphocytic (42)	Melanocytic (44)	
Mixed-breed	30,60%	24,64%	37,90%	22,72%	27,19%
Boxer	6,89%	14,20%	13,70%	11,36%	11,48%
Poodle	17,67%	17,37%	17,24%	6,81%	9,36%
Alsatians	7,75%	6,64%	6,80%	6,81%	6,94%
Cocker Spaniel	9,05%	3,08%	6,80%	9,09%	5,74%
Total	71,98%	52,10%	82,70 %	56,81%	60,72%

Table 3. Prevalence and age distribution of cutaneous tumors during the period from January 1998 to January 2008.

Age (years)	Tumors				
	Epithelial	Soft tissue sarcoma	Lymphocytic	Melanocytic	Total
<3	9	29	6	3	47
	1,35%	4,38%	0,9%	0,45%	7,09%
3-5	32	55	10	4	101
	4,83%	8,3%	1,51%	0,60%	15,25%
6-8	57	115	18	15	205
	8,61%	17,37%	2,71%	2,26%	30,96%
9-11	79	93	5	17	194
	11,93%	14,04%	0,75%	2,56%	29,30%
>11	42	65	3	4	114
	6,34%	9,81%	0,45%	0,60%	17,22%
Total	219	357	42	44	662
	33,08%	53,92%	6,34%	6,64%	100%

The malignant tumors (59,51%) were more frequent than the benign tumors (40,49%).

The chi-squared test was used to investigate possible correlations between the histological origins of the skin tumors and sex, breed and age. It showed that there was no relationship between sex and skin tumors ($P > 0,05$). Nevertheless, there was a positive relationship with breed and age ($P < 0,05$).

Among the purebred dogs, there were statistically greater occurrences of soft tissue sarcoma, lymphocytic and melanocytic tumors in boxers ($P < 0,05$), whereas there was greater occurrence of epithelial tumors in poodles ($P < 0,05$). Moreover, in a general manner, the occurrences of epithelial, soft tissue sarcoma, lymphocytic and melanocytic tumors were statistically greater among the mixed-breed ($P < 0,05$) (Table 2).

The occurrences of epithelial, soft tissue sarcoma and melanocytic tumors were statistically greater among dogs aged six to eleven years. Lymphocytic tumors were more frequent among animals aged less than three to 8 years old ($P < 0,05$) (Table 3).

DISCUSSION

Occurrences of different types of skin tumors in a given geographical area should be documented in order to gather information for future investigations. Knowledge of occurrences of different types of skin tumors in a defined population makes it possible for clinicians to refine their diagnosis and determine

treatment plans that are more effective for their patients (STRAFUSS, 1985), and this is the main reason for conducting this type of epidemiological studies (KALDRYMIDOU et al., 2002).

The way by which the results from this study are interpreted can be attributed to a variety of factors. Initially, this study only included specific cases coming from various cities in the northern and northeastern regions of the State of São Paulo, Brazil, in which the principal clinical suspicion was skin tumors. Nonetheless, there was the possibility that the malignity of the tumor, together with advanced age, might cause the dog's death. In such cases, necropsies were performed when the owners requested this and samples of the suspect material was sent for histopathological analysis. The classification of the different types of neoplasia was based only on the histopathological characteristics (WILLIAMSON; MIDDLETON, 1998; SOUZA et al., 2006). According to some authors, the criteria for histopathological differentiation of benign and malignant tumors has not yet been definitively established (MEUTEN, 2002; SCOTT et al., 2001).

Comparing the occurrences of the five most common skin tumor types described in this study (mast cell tumor, cutaneous histiocytoma, squamous cell carcinoma, fibrosarcoma and melanocytoma) with the literature consulted (BRODEY, 1970; MACVEAN et al., 1978; FINNIE; BOSTOCK, 1979; LADDS et al., 1983; BOSTOCK, 1986; ROTHWELL et al., 1987; ER; SUTTON, 1989; KALDRYMIDOU et al., 2002; PIRES et al., 2003,

SOUZA et al., 2006, PAKHRIN et al., 2007), divergences regarding the occurrences of squamous cell carcinoma, fibrosarcoma and cutaneous histiocytoma were seen in relation to these authors. These were probably due to differences in the tumor samples, diagnostic criteria and classification systems adopted (Table 4). However, both in the present study and in other studies (BRODEY, 1970; MACVEAN et al., 1978; FINNIE; BOSTOCK, 1979; BOSTOCK, 1986; ROTHWELL et al., 1987; ER; SUTTON, 1989; KALDRYMIDOU et al., 2002, PIRES et al., 2003, PAKHRIN et al., 2007), mast cell tumor was the most common tumor type. For this reason, such tumors are considered to be one of the most important types affecting dogs (BRODEY, 1970) The discrepancy in tumor occurrence observed in relation to the literature consulted (LADDS et al., 1983; LEVINE et al., 1990; MOULTON, 1990; GOLDSCHMIDT; SHOFER, 1992; HARGIS et al., 1992; SCOTT et al., 2001; KALDRYMIDOU et al., 2002) may relate to the population of dog breeds in the area studied and to environmental influences, especially exposure to ultraviolet light, which is responsible for the development of some skin tumors (BRODEY, 1970; MACVEAN et al., 1978; FINNIE; BOSTOCK, 1979; LADDS et al., 1983; BOSTOCK, 1986; ROTHWELL et al., 1987; ER; SUTTON, 1989; KALDRYMIDOU et al., 2002, PIRES et al., 2003, SOUZA et al., 2006, PAKHRIN et al., 2007). Thus, one explanation for the high occurrence of squamous cell carcinoma both in this study (57/662; 8,61%) and in Brisbane, Australia (ER; SUTTON, 1989) may relate to the long periods for which these dogs remain in environments exposed to high rates of solar radiation.

The results from the present study also demonstrates that malignant tumors were generally more frequent as benign tumors, which is in agreement with one other study (SOUZA et al., 2006), but goes against a large proportion of the literature consulted (BRODEY, 1970; MACVEAN et al., 1978; FINNIE; BOSTOCK, 1979; LADDS et al., 1983; BOSTOCK, 1986; ROTHWELL et al., 1987; ER; SUTTON, 1989; KALDRYMIDOU et al., 2002,

PIRES et al., 2003, PAKHRIN et al., 2007). This difference may relate to environmental and diagnostic factors or late diagnosis of these tumors.

Another observation in the present study was the presence of more than one type of tumor in 11 animals (1,70%), which corroborates the findings of two other studies that observed dogs with up to seven different types of tumors (MACVEAN et al., 1978; SOUZA et al., 2006). This finding is a reference for clinicians, who should be aware that, although the high chance that these tumors will be of same histological type, what increases the importance of sending more than just one of the tumors for analysis.

Breed predisposition to skin tumors has been emphasized in several studies (BRODEY, 1970; MACVEAN et al., 1978; BOSTOCK, 1986; ROTHWELL et al., 1987; ER; SUTTON, 1989; HARGIS et al., 1992; PIRES et al., 2003). In the present study, the pure breeds most affected were boxers, poodles, alsatians and cocker spaniels. This is probably a reflection of the frequencies of each of these breeds in the area studied, although the occurrence of skin tumors in these pure breeds is well known (ER; SUTTON, 1989). Boxers and cocker spaniels, for example, are breeds that are commonly affected by many types of skin tumors, such as mast cell tumor and perianal adenoma. However, we observed that poodles presented greater predisposition towards developing adnexal tissue tumors than were boxers. Alsatians and boxers were the breeds that presented the greatest predisposition towards developing mast cell tumor (BRODEY, 1970; MACVEAN et al., 1978; BOSTOCK, 1986; ROTHWELL et al., 1987; ER; SUTTON, 1989).

Around 77% of all the dogs affected by skin tumors were between six years old and over eleven years old. This shows that advanced age was also a predisposing factor for the observed occurrences of neoplasia, as reported by several authors (BRODEY, 1970; MOULTON, 1990; ROTHWELL et al., 1987; HARGIS et al., 1992; KALDRYMIDOU et al., 2002).

Table 4. Prevalence of the five most common cutaneous tumors diagnosed in this study and comparison with previous surveys

% Prevalence												
Neoplasmas	This study	USA*	USA†	AUS‡	AUS§	GBR	AUS¶	AUS**	GRE††	BRA††	POR§§	KOR
Mast cell tumor	20,0	21,3	20,5	17,6	11,2	19,2	16,1	16,0	13,8	20,9	14,0	8,6
Cutaneous												
histiocytoma	8,7	2,5	10,0	7,8	12,6	6,0	14,0	11,5	5,7	2,6	17,1	7,3
Squamous cell												
carcinoma	8,6	3,5	5,0	5,2	8,0	5,4	6,9	10,4	2,3	7,0	4,5	6,7
Fibrosarcoma	6,3	5,9	2,2	3,6	9,1	7,4	6,6	6,3	9,8	1,3	NR	1,1
Melanocytoma	6,0	5,0	10,4	6,8	9,4	6,3	3,5	8,2	2,8	3,3	3,7	2,36

NR not report

(*Brodey, 1970; †MacVean et al., 1978; ‡Finnie; Bostock, 1979; §Ladds et al., 1983; ||Bostock, 1986; ¶Rothwell et al., 1987; **Er; Sutton, 1989; ††Kaldrymidou et al., 2002; ††Pires et al., 2003; §§Souza et al., 2006; |||PAKHRIN et al., 2007)

Thus, our results allow us to state that the frequency of lymphocytic tumors among animals between zero and eight years old was high (Table 3). Some authors have also reported greater predisposition among young dogs towards developing histiocytoma (BRODEY, 1970; MACVEAN et al., 1978; BOSTOCK, 1986; ROTHWELL et al., 1987, PIRES et al., 2003).

The results from the present study are of great importance for small-animal clinics. They serve as a further tool in the attempt to direct the diagnosing of clinical suspicions of skin tumors in dogs as rapidly and precisely as possible. Thus, depending on the malignity of the tumors, clinicians will be able to safely plan their therapeutic strategies so as to promote cures or improve the quality of life for their patients.

Tumores cutâneos em cães. Estudo retrospectivo de dez anos

RESUMO

No presente estudo foram usadas 662 amostras de tumores cutâneos provenientes de 644 cães originados de várias cidades do Norte e Noroeste do Estado de São Paulo/Brasil no período de janeiro de 1998 a janeiro de 2008. As amostras avaliadas foram obtidas por necropsia (1,66%) e por excisão cirúrgica (98,33%) e processadas no Departamento de Patologia Veterinária da Faculdade de Ciências

Agrárias e Veterinárias de Jaboticabal, São Paulo, Brasil. Foram diagnosticados vinte e três tipos diferentes de tumores cutâneos e subcutâneos, sendo alguns animais (1,70%) afetados por mais de um tipo morfológico. Os sarcomas de tecido mole foram categorizados em oito tipos histológicos diferentes e apresentaram maior ocorrência (53,92%), seguidos pelos epiteliais (10 tipos; 33,08%), melanocíticos (dois tipos, 6,64%) linfocíticos (três tipos, 6,34%). Mastocitoma, histiocitoma, carcinoma de células escamosas, fibrossarcoma e melanocitoma foram os tumores mais comuns, compreendendo aproximadamente mais de 50% de todas as neoplasias cutâneas. De todos os animais 53,27% eram fêmeas e 46,73% eram machos; 72,81% eram cães de raça pura e 27,19% eram cães sem raça definida. De uma forma geral, os tumores malignos (59,51%) foram mais freqüentes do que os tumores benignos (40,49%). A ocorrência dos tumores epiteliais, sarcomas de tecido mole e melanocíticos também foi estatisticamente maior em cães com idade entre seis e 11 anos. Os tumores linfocíticos foram mais freqüentes em animais com idade menor que três até oito anos. Com isso este trabalho se mostra importante para os clínicos de pequenos animais como ferramenta para direcionar o diagnóstico das suspeitas de neoplasias cutâneas em cães o mais rápido e preciso possível.

Palavras-chave: tumores de pele, histopatologia, biopsia, cães.

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