

Evaluation of dogs with digit masses: 117 cases (1981–1991)

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Summary: Medical records of 117 dogs with digit masses were reviewed. Of 124 digit masses, 76 (61%) were malignant neoplasms, 25 (20%) were benign neoplasms, and 23 (19%) were pyogranulomatous inflammation. Of 29 digits with radiographic evidence of bone lysis, 24 (83%) were affected by malignant masses, whereas only 5 of 29 (17%) digits with radiographic evidence of bone lysis were affected by benign or pyogranulomatous masses. Only 1 of 19 (5%) dogs with melanoma had radiographic evidence of lysis, but 20 of 25 (80%) dogs with squamous cell carcinoma had radiographic evidence of bone lysis. Thoracic radiographs of 95 dogs were available. Six of 19 (32%) dogs with melanoma had radiographic evidence of pulmonary metastasis at the time of diagnosis, whereas 3 of 24 (13%) dogs with squamous cell carcinoma had radiographic evidence of pulmonary metastasis at the time of diagnosis. Twenty-nine digit neoplasms were squamous cell carcinoma, and 19 of 29 (66%) arose from the subungual epithelium. Of 19 dogs with squamous cell carcinoma originating from the subungual epithelium, 18 (95%) survived for at least 1 year, whereas only 6 of 10 (60%) dogs with squamous cell carcinoma originating in other parts of the digit survived for at least 1 year. Furthermore, of 19 dogs with squamous cell carcinoma originating from the subungual epithelium, 14 (74%) survived at least 2 years, whereas only 4 of 9 (44%) dogs with squamous cell carcinoma originating in other parts of the digit survived for 2 years. Dogs with melanoma of the digits had a median survival time of 12 months, with 10 of 24 (42%) alive at 1 year and 3 of 23 (13%) alive at 2 years. Dogs with mast cell tumor of the digits had a median survival time of 20 months, with 7 of 8 (88%) dogs alive at 1 year and 4 of 8 (50%) alive at 2 years.

Analysis of the results of the study reported here indicated that the prevalence of neoplasms in dogs with digit masses was high. Malignant neoplasms were more prevalent than benign neoplasms, with the most commonly identified types being squamous cell carcinoma and melanoma. Radiographic evidence of bone lysis was seen in dogs with all types of masses but was more commonly associated with squamous cell carcinoma than with melanoma. Dogs with melanoma of the digit had a higher prevalence of pulmonary metastasis and a poorer prognosis than dogs with squamous cell carcinoma.

Neoplastic and nonneoplastic digit masses in dogs can have similar clinical manifestations.¹ Squamous cell carcinoma arising from the subungual epithelium is reportedly the most commonly detected neoplastic mass

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Table 1—Prevalence of types of 101 neoplasms found on the digits of 117 dogs

Malignant			Benign		
	No.	Percentage		No.	Percentage
Squamous cell carcinoma	29	38.2	Benign adnexal tumor	5	20
Melanoma	24	31.6	Histiocytoma	4	16
Mast cell tumor	8	10.5	Hemangioma	4	16
Nerve sheath tumor	5	6.6	Basal cell tumor	3	12
Myxosarcoma	3	4.0	Intraosseous epidermoid cyst	3	12
Malignant adnexal tumor	2	2.6	Infiltrating lipoma	2	8
Fibrosarcoma	2	2.6	Fibroma	2	8
Lymphosarcoma	1	1.3	Plasmacytoma	2	8
Leiomyosarcoma	1	1.3			
Osteosarcoma	1	1.3			
Total	76	100		25	100



Figure 1—Photograph of an ulcerated mass, 2 cm in diameter, on digit III of the left forelimb of a dog. Excisional biopsy was performed, using digit amputation. Histologic diagnosis was melanoma.

of the digits of dogs.²⁻⁴ Dogs can have multiple digit masses that are a result of squamous cell carcinoma.^{3,5} Although neoplasms can metastasize to local and distant sites,^{3,5} to our knowledge, the prevalence of metastasis in a large number of dogs has not been reported. In 1 study, distant metastasis was reported to be uncommon; however, only a few dogs were evaluated by the use of thoracic radiography.⁴ Prognosis in dogs with neoplastic masses varies with the histologic type of neoplasm and the treatment modality used.⁶

Nonneoplastic digit swellings, as seen in dogs with pyogranulomatous inflammation, can cause clinical manifestations similar to those seen in dogs with neoplastic masses.⁷ The purpose of the study reported here was to retrospectively evaluate clinical findings, radiographic evaluations, and outcome after surgery of a large population of dogs with digit masses, to determine the prevalence and types of neoplasms as compared with the prevalence of pyogranulomatous inflammation, and to determine associations related with outcome.

Criteria for Selection of Cases

Medical records were reviewed to identify dogs that



Figure 2—Dorsoplantar radiographic view of the left hind limb of a dog with a mass on digit III. Notice the bone lysis of the second and third phalanges of digit III.

had biopsies of digit masses during a 10-year period (1981 to 1991). Of 129 dogs with digit masses, 117 dogs were included in the study reported here. Dogs were selected on the basis of completeness of medical records and adequate postoperative follow-up information. Each dog was evaluated by analyzing clinical history and results of physical examination, radiologic examination of the thorax, digit, or both (performed by JDS), and histologic examination of tissues (performed by SDM) obtained at the time of surgery. Biopsy specimens obtained during surgery were preserved in neutral-buffered 10% formalin, processed in a routine manner, and stained with H&E. Dogs were grouped according to weight as small (< 10 kg), medium (10 to 30 kg), and large (> 30 kg). All dogs initially underwent an excisional biopsy, with or without digit amputation. Dogs in which results of histologic examination of the biopsy specimen indicated that the mass was neoplastic underwent amputation of the affected digit, if it had not already been removed. Digit amputation was performed at the metacarpophalangeal/metatarsophalangeal or the proximal interphalangeal joint. Dogs with fibrosarcoma subsequently underwent limb amputation. Dogs did not receive chemotherapy or radiotherapy in conjunction with surgery. Follow-up examinations, including thoracic radiography, when possible, were performed on all dogs. Telephone interviews with owners were used to determine 1-year and 2-year survival rates. Statistical analysis comparing the results of clinical and radiographic findings with outcome was performed, using a 2-tailed Fisher's exact test. Frequency data were analyzed, using χ^2 testing. Differences were considered significant if $P \leq 0.05$.

Results

Medical records of 117 dogs with 124 digit masses were included in our study. Of the dogs, 64 (55%) were

Table 2—Results of histologic examination of masses in 19 dogs with radiographic evidence of metastatic pulmonary disease

Histologic classification	No. of masses	Detection of Metastasis					
		Prior to surgery		After surgery		Total	
		No.	(%)	No.	(%)	No.	(%)
Melanoma	19	6	32	5	26	11	58
Squamous cell carcinoma	24	3	13	4	17	7	29
Malignant adnexal tumor	1	0	0	1	100	1	100
Total	44	9		10		19	

Table 3—Comparison of 1-year and 2-year survival rates in dogs with squamous cell carcinoma arising from the subungual epithelium and squamous cell carcinoma of the digit arising from tissues other than the subungual epithelium

Tumor origin	No. of Dogs	Survival rates			
		1-year*		2-year	
		No.	(%)	No.	(%)
Subungual	19	18	95	14	74
Not subungual	10	6†	60	4†	40

*Analysis of survival rates, using Fisher's exact test, revealed groups of dogs had significantly ($P = 0.036$) different 1-year survival rates. †One dog was available for follow-up monitoring at 1 year after treatment, but not at 2 years after treatment.

large dogs, 39 (33%) were medium dogs, and 14 (12%) were small dogs. Males (72 of 117, 62%) were more numerous than females (45 of 117, 38%). Four dogs had 2 digit masses, and 1 dog had 4 digit masses. Of 124 masses, 76 (61%) were malignant neoplasms, 25 (20%) were benign neoplasms, and 23 (19%) were pyogranulomatous inflammation. There were several histologic types of malignant and benign neoplasms represented (Table 1).

The age of dogs with malignant neoplasms ranged from 4 to 16 years (median, 10 years), of dogs with benign neoplasms was 5 to 14 years (median, 7.5 years), and of dogs with pyogranulomatous inflammation was 1 to 13 years (median, 6.5 years). Forty-four masses were ulcerated (Fig 1). Of these 44, 31 (70%) were malignant masses, 7 (16%) were benign masses, and 6 (14%) were pyogranulomatous inflammation. Seventy-six of 124 (61%) digit masses were located in the forelimbs, and 48 of 124 (39%) were located in the hind limbs; there was no predilection for any particular digit.

Radiographs of 92 affected digits were available for evaluation. Of 29 digit masses causing bone lysis (Fig 2), 24 (83%) were malignant masses, which was significantly ($P = 0.006$) greater than for benign masses that resulted in bone lysis (5 of 29, 17%). Only 1 of 19 (5%) of the dogs with melanoma that had radiography of the digits had bone lysis, which was significantly ($P < 0.001$) less than the number of dogs (20 of 25, 80%) with squamous cell carcinoma that had bone lysis.

Large regional lymph nodes were palpable in 39 of 114 (34%) of the dogs, but none were biopsied. Thoracic radiography was performed on 95 dogs. Nine dogs had radiographic evidence of pulmonary metastasis at the time of diagnosis, and 10 dogs developed pulmonary metastasis after surgery (Table 2).

Twenty-nine digit masses were squamous cell carcinoma, including 4 digit masses in 1 dog. Of the 29

masses, 19 (66%) arose from the subungual epithelium. Results of analysis of 1-year and 2-year survival rates for dogs with squamous cell carcinoma originating from the subungual epithelium were compared with survival rates for dogs with squamous cell carcinoma of the digit originating from tissues other than the subungual epithelium (Table 3). Dogs with melanoma of the digits had a median survival time of 12 months. Of 24 dogs with melanoma of the digits, 10 (42%) were alive at 1 year, and 3 of 23 (13%) were alive at 2 years; information for 1 dog was not available for the 2-year evaluation. Dogs with mast cell tumor of the digits had a median survival time of 20 months, with 7 of 8 (88%) dogs alive at 1 year and 4 of 8 (50%) dogs alive at 2 years.

Discussion

One hundred one of 124 (81%) digit masses in the study reported here were benign or malignant neoplasms. Although the prevalence of digit masses that are neoplastic in dogs has not, to our knowledge, been reported, the actual prevalence of neoplasms in dogs with digit masses may be less than reported in our study, because we included only dogs that underwent biopsies. Seventy-six of 124 digit masses were malignant neoplasms, indicating that histologic examination of tissue removed from any digit mass in a dog is essential. Squamous cell carcinoma and melanoma were the most common histologic types of malignant neoplasms, which was similar to other reports.^{2,4,6}

Multiple masses on the digits, which is reportedly an uncommon finding,⁴ were seen in 5 of 117 (4%) dogs in the study reported here. Multiple masses of the digits were not associated with a specific limb or type of tumor and did not affect outcome.

Similar to other reports,^{2,6} malignant neoplasms were seen in our study in comparatively old dogs (median age, 10 years), whereas benign neoplasms and pyogranulomatous inflammation were seen in comparatively young dogs (median age; 7.5 and 6.5 years, respectively). Radiographic evidence of bone lysis was detected in dogs with neoplastic disease and pyogranulomatous inflammation; however, it was more prevalent in dogs with malignant neoplasms. Similar to previous reports,⁴ 20 of 25 (80%) dogs with squamous cell carcinoma had radiographic evidence of bone lysis; however, this was a significantly ($P < 0.001$) greater prevalence than for dogs with melanoma (1 of 19, 5%) that had evidence of bone lysis. Three dogs with benign masses (2 intraosseous epidermoid cysts and 1 infiltrating lipoma) had radiographic evidence of bone lysis. As reported previously, infiltrating lipomas and intraosseous epidermoid cysts have been associated with bone lysis of the digits.^{8,9}

Melanoma in the digits of dogs has a high rate of metastasis.⁶ In our study, 6 of 19 (32%) dogs with melanoma of the digits were found to have pulmonary metastasis on presurgical thoracic radiography. Five dogs with melanoma of the digits developed pulmonary metastasis after surgery and were euthanatized soon after surgery because of related pulmonary disease.

Pulmonary metastasis in dogs with squamous cell

carcinoma of the digits reportedly is a common condition,⁶ but other investigators have found it to be an uncommon condition.⁴ In the latter study, only 4 of 21 (19%) dogs were evaluated by means of thoracic radiography for pulmonary metastasis before surgery, and only 3 of 21 (14%) had follow-up thoracic radiography. In our study, 3 of 24 (13%) dogs with squamous cell carcinoma had evidence of pulmonary metastasis at the time of diagnosis. Additionally, 4 dogs developed pulmonary metastasis after surgery and were euthanatized soon after surgery because of related pulmonary disease. Differences in findings may have been attributable to the use of different monitoring techniques.

The prognosis of dogs with squamous cell carcinoma can be influenced by location of the tumor.⁶ In our study, dogs with squamous cell carcinoma originating from the subungual epithelium had significantly ($P = 0.036$) higher 1-year survival rates (18 of 19, 95%), compared with dogs with squamous cell carcinoma originating in other parts of the digit (6 of 10, 60%). The 2-year survival rates for dogs with squamous cell carcinoma originating from various tissues were not significantly different; however, this may have been the result of too few dogs in our study. Evaluation of more dogs is warranted before conclusions on long-term survival can be made.

Analysis of results of the study reported here indicated that the prevalence of neoplasms in dogs with digit masses was high (101 of 124, 81%). Malignant neoplasms were more prevalent than benign neoplasms, and the most common histologic types were squamous cell carcinoma and melanoma. Radiographic evidence of bone lysis can be detected with all histologic types of masses, but were more commonly associated with squamous cell carcinoma than with melanoma. Dogs with melanoma of the digits had a higher prevalence of pulmonary metastasis and a poorer prognosis than dogs with squamous cell carcinoma of the digits.

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