Epidemiological Features of Canine Renal Neoplasms

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SUMMARY

A retrospective study of medical records from 13 veterinary university hospitals and clinics yielded 73 cases of confirmed primary neoplasms of the kidney and renal pelvis. Analysis of the 34 cases of renal carcinoma revealed no evidence of familial (breed) predisposition, but an excess risk was identified in males, especially during middle life. The morphological and epidemiological features of canine renal carcinoma are similar to those of renal carcinoma in humans. The dog may be a suitable model for further research into the causes of this cancer.

INTRODUCTION

In humans, renal cancer accounts for 2% of all malignant neoplasms (12), but little is known about etiology. Since the urinary system in dogs is histologically and functionally similar to that in humans and responds in a like fashion to known carcinogenic agents (8), it seems appropriate to investigate the distribution of spontaneous canine renal tumors and draw comparison with the lesion in humans.

MATERIALS AND METHODS

Data for this study came from medical abstracts submitted by hospitals and clinics of 13 North American veterinary universities participating in the Veterinary Medical Data Program. The Veterinary Medical Data Program is a data registry, sponsored by the National Cancer Institute, to which participants submit a standardized case abstract, systematically coded (38), about each clinical episode at their facility. As of June 1975, there were 1.4 million clinic visits documented in the registry; approximately 60% were about dogs.

The Veterinary Medical Data Program abstract contains descriptive information about the patient (i.e., identity number, age, breed, and sex), diagnoses, operations, and diagnostic procedures used during that visit. Also submitted are data about visits for physical examinations and routine vaccinations, but not drug therapy. One identity number is assigned to a patient regardless of the number of subsequent visits made to the medical facility. When the pedigree is not available, the determination of breed of the animal is based upon the phenotypic appearance. The relevant information collected about tumors includes site, cell type, and behavioral pattern.

Dogs with histologically confirmed tumors of the kidney and renal pelvis were identified, as was a reference population composed of all dogs seen once for each year during the study period (hospital-clinic patient-years-at-risk); return visits by the case series were excluded. Both the case series and the reference population were tabulated by age, breed, and sex.

The measure of association used in this study was an estimate of relative risk (R) as approximated by the relative odds ratio (34). The procedure used to compute the maximum likelihood estimate of R, with stratification of control variables, has been described by Gart (20), and the computer procedure for the computation was described by Thomas (47).

For each summary R value, 95% confidence intervals were calculated by the method of Gart (20). These intervals were a measure of the statistical confidence of R; if they did not include 1, then the calculated R would be considered significantly different from the R of the comparison group at the 0.05 level. A less than 1 indicated a lower risk for the disease in the test group versus the comparison group; R greater than 1 indicated a higher risk.

RESULTS

Seventy-three dogs were identified with primary renal neoplasms; 67 involved the kidney, and 6 involved the renal pelvis. Adenocarcinoma was the most frequent cell type, followed by carcinoma not otherwise specified and embryonal nephroma (Table 1). Subsequent analyses of age, breed, and sex risk were limited to "renal carcinoma" encompassing the 34 cases of adenocarcinoma and carcinoma (not otherwise specified) of the renal parenchyma. Review of the medical histories of these dogs revealed a male with another primary tumor of the urogenital system, a transitional cell carcinoma of the bladder developing 2 months after the diagnosis of renal carcinoma.

R values were calculated for breeds represented by 3 or more cases of renal carcinoma. Mixed breed (mongrel) dogs predominated with 12 cases, followed by 3 cases each among Labrador retrievers and miniature and toy poodles. None of these breed groups had a risk significantly different from that in all breeds combined (Table 2). Fourteen other breeds not qualifying for risk analysis were represented among dogs with renal carcinoma.

In both sexes, the risk for renal carcinoma increased with age (Chart 1). However, males had an overall risk 2.3 times that of females, based on 23 versus 11 cases, respectively (95% confidence interval = 1.05 to 4.94). The excess in males was primarily over 3 years of age (Chart 2).
Canine renal neoplasms by sex reported to the Veterinary Medical Data Program, March 1964 to July 1975

<table>
<thead>
<tr>
<th>Site/cell type</th>
<th>Total cases observed</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Kidney Adenocarcinoma</td>
<td>67</td>
<td>24</td>
</tr>
<tr>
<td>Carcinoma not otherwise specified</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>Embryonal nephroma</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Fibrosarcoma</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Adenoma</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Sarcoma not otherwise specified</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Hemangiosarcoma</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Hemangioma</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Fibroma</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Lipoma</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Renal pelvis Squamous cell carcinoma</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Carcinoma not otherwise specified</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Fibrosarcoma</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

| Estimated relative risk (R) of renal carcinoma in dogs by breed R values compared with that in all breeds combined (R = 1) and stratified on age and sex. |

<table>
<thead>
<tr>
<th>Breed group</th>
<th>No. of cases observed</th>
<th>R</th>
<th>95% confidence interval^a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed breed</td>
<td>12</td>
<td>1.5</td>
<td>0.87-3.80</td>
</tr>
<tr>
<td>Labrador retriever</td>
<td>3</td>
<td>2.7</td>
<td>0.70-9.72</td>
</tr>
<tr>
<td>Miniature and toy poodles</td>
<td>3</td>
<td>0.9</td>
<td>0.23-3.19</td>
</tr>
</tbody>
</table>

^a When confidence interval includes 1, breed R is not significantly different from that in all breeds combined at the 0.05 level.

This series contained 6 females and 2 males with Wilms' tumor (Table 3). Review of the medical histories of these dogs failed to detect any congenital defects reported with Wilms' tumor in children (37).

In humans, tumors of the renal pelvis (25) and, possibly, renal carcinomas (3) have been linked with analgesic drug use. The medical histories of dogs with these lesions were reviewed for diseases routinely treated with salicylates. One of the 6 dogs with a neoplasm of the renal pelvis and 1 of the 34 dogs with renal carcinoma had a history of arthritis. No other conditions were identified.

DISCUSSION

Our findings, although based upon a well-defined hospital-clinic population of more than 250,000 dogs, are nevertheless subject to possible biases associated generally with retrospective studies and specifically with pet ownership. Although the Veterinary Medical Data Program includes medical episodes for non-disease visits and may therefore approximate the general population-at-risk, our results cannot be considered as incidence statistics. Estimates of relative risk in this study represent hospital-based prevalence values.

At least 110 canine renal carcinomas (4, 5, 7, 9, 10, 13-15, 22, 23, 27, 30, 31, 33, 40, 48), 22 Wilms' tumors (1, 5, 10, 16, 18, 24, 41, 43), and 70 other tumors of the kidney and renal pelvis have been reported (6, 11, 17, 35, 36, 45). However, reference populations for comparison were either lacking or not suitable for use, so that the reported variations in diagnosis by age, breed, and sex are uninformative.

The largest canine series reported, which describes the morphological characteristics of 31 cases of renal carcinoma, was based on material from the Armed Forces Institute of Pathology (5). The authors, in agreement with Willis (49), concluded that the canine lesion is histologically very similar to the human counterpart. Because of this similarity, a comparison of epidemiological features is especially relevant.

In our series, there was no evidence of familial (breed) predisposition among purebred dogs. A high proportion of the cases were in mongrel dogs which suggests that, as in humans (46, 50), genetic determinants of renal carcinoma are not conspicuous.
Canine Renal Neoplasms

Table 3
Cases of embryonal nephroma reported in dogs

<table>
<thead>
<tr>
<th>Breed group</th>
<th>Sex</th>
<th>Age at diagnosis</th>
<th>Discharge status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed breed</td>
<td>Male</td>
<td>5 mos.</td>
<td>Euthanasia</td>
</tr>
<tr>
<td>Mixed breed</td>
<td>Female</td>
<td>1 yr</td>
<td>Alive</td>
</tr>
<tr>
<td>Mixed breed</td>
<td>Female</td>
<td>2-3 yr</td>
<td>Euthanasia</td>
</tr>
<tr>
<td>Mixed breed</td>
<td>Female</td>
<td>4-6 yr</td>
<td>Euthanasia</td>
</tr>
<tr>
<td>Mixed breed</td>
<td>Male</td>
<td>7.5 yr</td>
<td>Alive</td>
</tr>
<tr>
<td>German shepherd</td>
<td>Female</td>
<td>3 yr</td>
<td>Alive</td>
</tr>
<tr>
<td>Miniature poodle</td>
<td>Female</td>
<td>6 yr</td>
<td>Alive</td>
</tr>
<tr>
<td>Shetland sheepdog</td>
<td>Female</td>
<td>8 yr</td>
<td>Euthanasia</td>
</tr>
</tbody>
</table>

Our analysis quantifies, for the first time, an excess risk of renal carcinoma in male dogs. This finding stands in contrast to the female predominance of canine bladder cancer, which may be related to the bitch’s tendency toward prolonged urine retention (21). The male predominance of canine renal carcinoma resembles that in humans (Chart 2). The canine male excess peaks in the 7- to 9-year age group. Using LeBeau’s conversion of dog years to human years (32), the mean of this age group approximates 49 years of age in humans. Similarly, the sex ratio of male-to-female incidence rates in humans is greatest at 45 to 49 years of age (12).

The primary causes of renal carcinoma in humans are unclear. A relationship to cigarette smoking has been suggested, but the evidence is inconclusive (3, 19, 29, 50). Occupational exposures to polycyclic hydrocarbons among coke oven workers in the steel industry and to cadmium have been implicated in some cases (29, 39). Worldwide trends indicate a correlation of renal carcinoma with consumption of coffee (44) and with animal fat and protein (2), but these hypotheses were not sustained by a case-control study (3).

The reason for the male predominance of human renal carcinoma is obscure. Environmental factors are suggested by the rising incidence reported among American men but not women (26) and call for further studies to evaluate the role of tobacco, nutrition, and occupational determinants. However, these factors cannot account for the male excess of kidney cancer in dogs (and similar trends in sex ratio with age) and suggest the influence of host susceptibility, including the endogenous production or metabolism of sex hormones. This possibility is consistent with the evidence for remission in some human patients with renal carcinoma using progesterins (28, 42).

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REFERENCES


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