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TUMORS OF THE UROGENITAL SYSTEM IN DOGS AND CATS. RETROSPECTIVE REVIEW OF 138 CASES

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Abstract. The aim of the study was to estimate the prevalence and localization of different tumors in the urogenital system in dogs and cats in relation to sex, age and breed of animals. The study was performed on tumors or tissue specimens from tumors of the urinary and genital system obtained during surgery from dogs and cats submitted to the Division of Pathological Anatomy, Department of Clinical Sciences Agricultural University of Warsaw from 1998 to 2005. Most tumors of the urogenital system recognized in the present study derived from dogs (94.20 %, 130 cases), and only a few cases were obtained from cats (5.79 %). Occurrence and localization of urogenital system tumors in present review is similar to findings reported by other authors. Testicular tumors in males, ovarian lesions in females and urinary bladder tumors in both sexes were most commonly recognized. Older dogs were most often affected, animals with nonmalignant tumors were a bit younger than those with malignant lesions. Any obvious breed predilections were found, but terriers were at increased risk for development of transitional cell carcinoma of the urinary bladder and mixed breed and German shepherd for development of testicular neoplasms.

Keywords: urogenital tumors, dog, histopathology, testicular tumors.

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INTRODUCTION

Neoplasms of the urinary and genital system are rare in dogs and cats. Among them, tumors of the testis in males, vagina in females, and urinary bladder in both sexes are most common. Early surgical castration means that some tumors are extremely rare, for example testicular tumors in male cats. The true prevalence of these neoplasms is unknown, because reports in the literature are based largely on necropsy surveys and biopsy submissions. Various diagnostic methods of visualization, especially radiography and ultrasonography are more popular and thus some types of neoplasms, including urogenital ones, are more commonly recognized (Johnston et al. 1991, Norris et al. 1992). Generally, surgical castration of the companion animals causes, in some cases decreased prevalence of many neoplastic lesions (early castration). On the other hand, late castration makes possible incidental detection of early lesions during surgical intervention, which do not have any clinical manifestations and cannot be found during basic clinical evaluations.

There are not too many detailed data on occurrence of tumors of the urogenital system in dogs and cats in Polish literature, but some papers do mention this issue (Piórkowski et al. 2006). One of the most important factors that decide about treatment and prognosis in veterinary oncology is final diagnosis obtained by microscopic examination of the excised tumor or sample of its tissue in the histopathological laboratory by cytologic and/or histologic examination. The aim of this study was to estimate the prevalence and localization of different tumors in the urogenital system in dogs and cats in relation to sex, age and breed of animals.
MATERIALS AND METHODS

The study was performed on tumors or tissue specimens from tumors of the urinary and genital system obtained during surgery from dogs and cats submitted to the Division of Pathological Anatomy, Department of Clinical Sciences, Warsaw Agricultural University from 1998 to 2005. Samples were fixed in 10 % buffered formalin, dehydrated and embedded in paraffin. Paraffin blocks were cut on 4 μm slides, stained with hematoxylin and eosin and other histochemic and immunohistochemic methods (expression cytokeratin, desmin) if needed. The sex, age and breed of animals were recorded, and the detailed localization of masses was also noted. On the basis of microscopic examination, according to generally accepted histologic and cytologic criteria, a final histopathologic diagnosis was made.

RESULTS

Most tumors of the urogenital system recognized in the present study derived from dogs (94.20 %; 130 cases), and only a few cases were obtained from cats (5.79 %). In cats there were diagnosed only 8 cases of these tumors; the mean age of affected cats was 7.25 years. Most neoplasm were malignant (75 %), and only two (both uterine leiomyomas) were benign. There were no cases of male genital system tumors in cats. Characteristics of feline urogenital tumors are summarized in Tab. 1.

Tab. 1 Characteristic of feline urogenital tumors.

<table>
<thead>
<tr>
<th>sex</th>
<th>age</th>
<th>localization</th>
<th>diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>female</td>
<td>1.5</td>
<td>left kidney</td>
<td>nephroblastoma</td>
</tr>
<tr>
<td>male</td>
<td>7</td>
<td>left kidney</td>
<td>carcinoma</td>
</tr>
<tr>
<td>male</td>
<td>4</td>
<td>urinary bladder</td>
<td>hemangiosarcoma</td>
</tr>
<tr>
<td>female</td>
<td>4.5</td>
<td>left ovary</td>
<td>fibrosarcoma</td>
</tr>
<tr>
<td>female</td>
<td>15</td>
<td>vagina</td>
<td>adenocarcinoma</td>
</tr>
<tr>
<td>female</td>
<td>9</td>
<td>uterus</td>
<td>leiomyoma</td>
</tr>
<tr>
<td>female</td>
<td>9</td>
<td>uterus</td>
<td>adenocarcinoma</td>
</tr>
<tr>
<td>female</td>
<td>8</td>
<td>uterus</td>
<td>leiomyoma</td>
</tr>
</tbody>
</table>

The occurrence and localization of different urogenital system tumors in dogs, mean of age (range), and sex distribution (urinary system) in dogs is summarized in Tab. 2.
Tab. 2. Occurrence and localization of different urogenital system tumors in dogs.

<table>
<thead>
<tr>
<th>localization</th>
<th>Number of cases (% of all cases)</th>
<th>mean of age (range)</th>
<th>Sex distribution female/male</th>
</tr>
</thead>
<tbody>
<tr>
<td>urinary system</td>
<td>32 (26.66)</td>
<td>9.11 (5-13)</td>
<td>18/14</td>
</tr>
<tr>
<td>kidney</td>
<td>6 (4.61)</td>
<td>8.67 (6-12)</td>
<td>4/2</td>
</tr>
<tr>
<td>urinary bladder</td>
<td>23 (17.69)</td>
<td>9.02 (5-13)</td>
<td>11/12</td>
</tr>
<tr>
<td>urethra</td>
<td>3 (2.3)</td>
<td>10.67 (8-12)</td>
<td>3/0</td>
</tr>
<tr>
<td>female genital system</td>
<td>36 (27.69)</td>
<td>8.95 (2-14)</td>
<td>only females</td>
</tr>
<tr>
<td>ovary</td>
<td>14 (10.76)</td>
<td>9 (5-12)</td>
<td></td>
</tr>
<tr>
<td>uterus</td>
<td>3 (2.3)</td>
<td>11 (8-14)</td>
<td></td>
</tr>
<tr>
<td>vagina</td>
<td>19 (14.61)</td>
<td>8.66 (2-13)</td>
<td></td>
</tr>
<tr>
<td>male genital system</td>
<td>62 (47.69)</td>
<td>9.96 (1.16-16)</td>
<td>only males</td>
</tr>
<tr>
<td>testes</td>
<td>55 (42.38)</td>
<td>10.29 (1.16-16)</td>
<td></td>
</tr>
<tr>
<td>prostate and penis</td>
<td>7 (4.92)</td>
<td>7.08 (1.5-12)</td>
<td></td>
</tr>
</tbody>
</table>

The majority of tumors recognized in the kidney of dogs were malignant lesions (83 %); only one case of benign tumor (hemangioma) was noted. Among the malignant tumors renal carcinoma (3 cases) dominated and, mesenchymal tumors (1 liposarcoma and 1 sarcoma) were the most rare. Histologic types of all urinary bladder tumors (n=23) in dogs are illustrated in Fig 1. Urethral tumors were noted only in female animals and include transitional cell carcinomas (two cases) and one fibrosarcoma. Neoplasm of the female genital system (n=36) were found within the ovary (n=14), uterus (n=3), and vagina (n=19). Many tumors were obtained from mixed breed dogs (28 %) and German shepherds (17.5 %), additionally two from great Danes, boxers and dachshunds, and other breeds were represented by single cases. Ovarian neoplasms were mostly epithelial in origin (71.5 %) and malignant (64 %), ovarian stromal tumors were rarely recognized, among them only granulosa cell tumors were noted (3 cases). In one case haemangiosarcoma of the ovary extending to the uterus was recognized. Uterine tumors derived from mesenchymal tissue: smooth muscle fibers (leiomyoma and leiomyosarcoma) and fibroblasts (fibrosarcoma), were localized within the uterine corpus. In one case leiomyoma developed within uterine remnants after hysterectomy. The most numerous female genital tumors in the dogs were localized within the vagina; histologic characteristics of these neoplasms are illustrated in Fig 2. In male dogs tumors of
the genital system were recognized in 62 cases, most of them were testicular tumors (89%), lesions were seldom localized within the penis (4 cases of transmissible venereal tumors, one melanoma and one carcinoma) and in the canine prostate only one case of adenocarcinoma was found. Histologic types of all testicular tumors are illustrated in Fig 3.

DISCUSSION

It is not surprising that the more of the analyzed tumors were obtained from dogs than from cats. Dogs are the most common patients of veterinary clinics and most tissue samples sent to histopathologic examination are derived from dogs, but generally tumors of the urogenital systems are most common in this species of animals than in cats (Coley and Waters 2001, McLachlan and Kennedy 2002). Both male and female cats are castrated early to prevent sexual behavior, thus preventing the occurrence of some types of pathologic lesions too. No case of male genital tract tumors was recognized in cats in the present study, but most neoplasms concerned the female genital tract in cats. Only a few cases of testicular or prostatic tumors in both intact and castrated male cats exist in the literature (Caney et al. 1998, Miyoshi et al. 2001, Benazzi et al. 2004, Doxsee et al. 2006). The majority of the lesions recognized in the cats in the present study were localized in the uterus (38%), whereas uterine tumors in bitches were rather rare (2.5% of all urogenital neoplasms). Generally uterine tumors are rare lesions in both dogs and cats and often they are an incidental finding during hysterectomy, especially leiomyomas which do not give clinical signs.

Most of the tumors recognized in dogs in the present study were derived from the male genital system, actually from the testes, these tumors according 42% of the cases analyzed. Most tumors were localized in the left testis; both gonads were affected in 1 case (Fig. 4). Three distinct histologic types of tumors occur within the canine testis with approximately equal frequency, but among all testicular tumors in this study seminomas, leydigomas and sertoliomas occurred in, respectively, 62%, 16% and 13% of cases. Other neoplasms of the canine testis, both in the literature and in our study (3 types of neoplasm were recognized - gonadoblastoma, adenomatoid tumor and mesothelioma) occur with much less frequency (Cooley and Waters 2001). Two distinct
types of neoplasms in one specimen were noted only in 2 cases (leydigoma + seminoma, leydigoma + sertolioma), but in general, according to the literature up to 40 % of dogs that develop testicular neoplasms have more than one testicular tumor. Most of the dogs in this study were older animals, and the mean age was over 10 years; similar findings were obtained by other authors (Coley and Waters 2001). The general opinion is that dogs less than 6 years of age are at low risk of developing testicular neoplasm, and virtually only 5.5 % of animals in this review were younger than 6 years; the youngest was a 14 month-old mongrel (Cooley and Waters 2001). There were some differences in mean age between dogs with a distinct type of testicular neoplasm in the present study. Dogs with seminomas (mean age: 10.1 years) were older than animals with sertoliomas (8.7 years), but younger than those with leydigomas (11.1 years). Similar results were obtained by Nieto et al. (1989), but in their work the mean age of dogs with seminomas was 8.8 years; additionally those in which sertoliomas developed in cryptorchid testes were younger than dogs with sertoliomas recognized in descended testes (Nieto et al. 1989). Breed-specific differences in risk for testicular tumors have been found in dogs. For example boxers, German shepherd, Afghan, weimaraner and Shetland sheepdog are thought to be predisposed to the development of these neoplasms, whereas decreased risk was reported in the Dachshund and mixed-breed dogs (Hayes and Pendergrass 1976). In the present study most dogs with testicular tumors were mixed-breed dogs (33 % of all animals with testicular tumors) or German shepherd (13 %). On the other hand, in some breeds the relative risk was increased for a particular histologic type of testicular tumor, rather than for all testicular tumors. All tumors surveyed were derived from descended or cryptorchid testes, but none originated from an extratesticular location. Primary neoplasms were derived from testicular tissue, and in extratesticular location are extremely rare, but were noted in both castrated dogs and cats; in these cases the presence of embriological ectopic tissue or the presence of testicular tissue transplanted during surgery, are thought to be a cause (Doxsee et al. 2006). In the present study some dogs with sertoliomas had clinical signs in accordance with the feminization syndrome, for example, symmetrical truncal alopecia, gynecomastia, and atrophy of the unaffected gonad.
Additionally, in one case in this study increase in the serum level of estradiol (70.0 pg/ml; range 15.0-60.0 pg/ml) and testosterone (2.5 pg/ml; range 0-0.5 pg/ml) was noted. Feminization syndrome and bone marrow hypoplasia is most commonly associated with the presence of sertolioma, but the relation between interstitial cell tumors and seminoma and feminization syndrome in male dogs have also been described in the literature (Suess et al. 1992, Kim and Kim 2005).

The second most numerous group of tumors in dogs in the present study were lesions localized in the urinary bladder. These neoplasms occurred in 17.69 % of all recognized neoplasms and 71.87 % of lesions of the urinary system of dogs. Most tumors of the urinary bladder and urethra in dogs, are malignant (97 %) and epithelial in origin (97 %) ( Norris et al. 1992, Cooley and Waters 2001). In the present study the majority of these tumors were epithelial in origin (73 %) and malignant (77 %), transitional cell carcinomas (TCC) were particularly common, but benign lesions – papillomas-were noted too (Nieto et al. 1992). There was no sex predisposition for urinary bladder tumor development in the present study, but some authors emphasize that these neoplasms are more common in bitches (Cooley and Waters 2001). Most types of recognized tumors were equally frequent in both sexes, except neoplasms of the urethra which were found only in females. It is generally known that terriers, particularly Scottish terriers, are predisposed to development of TCC, whereas the German shepherd and golden retrievers were significantly underrepresented among dogs with lower urinary tract tumors in some studies (Norris et al. 1992, Knapp 2001). Precise estimation of breed predisposition TCC occurrence in the present study was impossible to establish, but among animals with urinary bladder neoplasms terriers were present only among dogs with transitional cell carcinomas. The mean age of animals with the bladder and urethral tumors in the present survey was 9 years; this is in with data in the literature; however, our dogs with mesenchymal and nonmalignant neoplasms were somewhat younger than animals with malignant and urethral neoplasms. Transitional cell carcinomas usually derived from the urinary bladder epithelium, but sometimes growth occurred in the renal pelvis or urethrae (Militerino et al. 2003). In the present study there was no TCC of the renal pelvis, but two cases of these neoplasms in urethra
Among tumors of the female genital system, vaginal and ovarian lesions dominated in the present survey, and neoplasms of the uterus were only rarely noted. However, tumors of the ovary and uterus are uncommon in dogs. This is probably due to the fact that a large portion of the canine population is neutered at an early age. For example, the reported incidence of ovarian tumors in intact bitches is 6.25% according to older data (Crow 1960) and 0.5% to 1.2% in a more recent study (Bertazzolo et al. 2004).

Vulvar and vaginal tumors account for 2.4% to 3% of canine neoplasms. They are the most common canine female reproductive tumor after those of the mammary gland (Klein 2001). Although the majority of vaginal lesions in bitches are benign, in the present study almost half were malignant and arose from both mesenchymal (fibrosarcoma and leiomyosarcomas) and epithelial tissues (adenocarcinoma and squamous cell carcinoma). Nonmalignant tumors were mostly mesenchymal in origin (fibromas and leiomyomas) and only one case of papilloma was recognized. The mean age for bitches with vaginal tumors in the present review was similar to data in the literature. However, animals with benign neoplasms were slightly younger than those with malignant neoplasms; likewise, dogs with lipomas in the report by Brodey and Roszel (1967). Additionally, female dogs with transmissible venereal tumors were much younger than those with malignant and benign lesions. In accordance with data in the literature, in the present study there was no obvious breed predilection for the occurrence of any type of vaginal neoplasm, but some authors found that boxers were at increased risk (Thacher and Bradley 1983). Most bitches reported in the present study were mixed breed (33% of cases) and, beside other breeds, one female boxer was noted.

The most common primary tumors of the kidney in animals include renal tubular cell carcinoma and nephroblastoma, non epithelial tumors are particularly rare, but have been described in dogs, for example leiomyosarcoma (Sato et al. 2003, Bennet 2004). In the present study renal tumors occurred in 5% of all urogenital neoplasms and 16.5% of urinary neoplasms; half of them
were of epithelial origin (renal carcinomas) and the remainder were mesenchymal tumors (sarcoma, liposarcoma and angioma). Primary renal tumors are uncommon in dogs and account for less than 2 % of all canine cancer, while tumors that have metastasized to the kidney are more frequent (Klein et al. 1988, Knapp 2001). In the present study in specimens obtained by surgery there were no cases of metastatic lesions, but the authors observed many of these cases in tissues obtained during autopsy. This situation is probably due to fact that animals with metastatic disease are not treated and only dogs with localized tumors (primary renal tumors) are operated on, lesions are excised surgically and evaluated histologically. All the neoplasms described were unilateral, but in general bilateral involvement is common in cases of renal lymphomas and renal tubular cell carcinomas (Knapp 2001). In fact, one author recognized (ultrasonography and fine needle aspiration biopsy, histologically confirmed) a case (not included in this review) of bilateral renal lymphoma in a mixed-terrier female, 13 year-old dog. Among dogs with primary renal tumors in the present study there were only dachshunds, boxers and mongrels; however, no breed predilection for the occurrence of any type of renal tumor have been described in the literature (Knapp 2001).

In the present study the ovarian tumors in dogs were epithelial in origin (71 %), sex-cord stromal neoplasms were rare and lesions derived from germ cells were not observed. The last group of tumors occurs most seldom, but in some surveys has been described in 20 % of cases (Brazell and Borjesson 2006). The most common lesions arise from the epithelium of the ovary (lining epithelium, the rete ovarii, and subsurfaces epithelial structures; MacLachan and Kennedy 2002, Yotov et al. 2005). The only sex cord tumors of the ovary in the present study were granulosa cell tumors, which consist of the regular accumulation of granulosa cells separated by a supporting stroma of spindle cells. All our cases of ovarian tumors had grown within normal gonads but these lesions have also been described in spayed bitches (Sivacolundhu et al. 2001).

Neoplasm of the uterus are the rarest recognized tumor of the female genital system in dogs, reported incidence rates are 0.3 % to 0.4 % of all canine tumors (Klein 2001). In the present study, only 10 % of all tissue samples derived from the genital system in bitches sent for
histopathological examination originated from the uterus. All recognized lesions derived from mesenchymal tissue, especially from smooth muscle fibers. These results are consistent with findings obtained in other studies, where leiomyomas and leiomyosarcomas account for 95-100 % of microscopic diagnoses (Herron 1983, Klein 2001). Neoplasms can grow in different parts of an organ, but the presence of tumors in hysterectomized animals has been described. In one case presented in this study leiomyoma was recognized in remnants of the uterine corpus in a rottweiler. Dogs with uterine tumors were older than animals with neoplasms localized in the ovary and vagina; however, in the literature there were cases of malignant lesions in bitches as young as 10 months old (Cave et al. 2002).

We conclude that occurrence and localization of urogenital system tumors in the present review is similar to findings reported by other authors. Testicular tumors in males, ovarian lesions in females and urinary bladder neoplasms in both sexes were most commonly recognized. Older dogs were most often affected, and animals with nonmalignant tumors were slightly younger, than those with malignant lesions. No obvious breed predilections were found, but terriers were at increased risk for development of transitional cell carcinoma of the urinary bladder and mixed breeds and German shepherds for development of testicular neoplasms.
REFERENCES


Fig. 1. Histologic types of all urinary bladder and urethral tumors in dogs

Fig. 2. Histologic types of all vaginal tumors in dogs
Fig 3. Histologic types of all testicular tumors in dogs.
Fig. 4. Bilateral and different histologic type tumors in canine testes (A) macroscopic appearance of diffuse seminoma; (B) microscopic view of diffuse seminoma (hemotoksyline-eosin stain, magnification 400 x); (C) macroscopic appearance of clinically undetected leydigoma (arrow); (D) microscopic view of leydigoma (hemotoksyline-eosin stain, magnification 200 x).