Mammary duct ectasia in dogs: 51 cases (1992–1999)

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Objective—To evaluate the clinical and pathologic characteristics of mammary duct ectasia in dogs.

Design—Retrospective study.

Animals—51 dogs with mammary duct ectasia.

Procedure—Information regarding body condition, history, number and location of affected mammary glands, appearance of lesions, surgical treatment, nonsurgical treatment, and evidence of recurrence or development of mammary neoplasia was obtained from surveys sent to referring veterinarians. Results of information from examination of histologic sections and referring veterinarians were evaluated for all mammary duct ectasia biopsies performed between 1992 and 1999.

Results—Duct ectasia was the primary diagnosis in 51 of 1,825 (2.8%) mammary biopsy specimens and comprised 48% of nonneoplastic mammary diseases. Affected dogs were evenly distributed over a range of 1 to 13 years of age, with a mean age at the time of diagnosis of 6.1 ± 3.1 years. All dogs were female (31 sexually intact, 20 spayed); 10 of 26 had whelped. Duct ectasia was described as nodular (26 dogs), cystic (13), and multiglandular (11) and located in caudal (31) more often than cranial (14) or middle glands (10). Ectasia recurred in 3 dogs. One dog had a history of previously excised mammary adenocarcinoma; another subsequently developed mammary carcinoma.

Conclusions and Clinical Relevance—Duct ectasia affected mature, sexually intact and spayed female dogs over a wide age range. Certain breeds were affected more commonly than expected. Increased risk for mammary neoplasia was not evident. Duct ectasia should be considered as a cause for mammary enlargement, especially in young dogs or when its cystic nature is evident. Mastectomy is usually curative, and neoplasia should be ruled out in dogs with ectasia. (*J Am Vet Med Assoc* 2001;218:1303–1307)

Duct ectasia is defined as dilatation of collecting ducts by inspissated secretions.[1] In the breasts of humans, the lesion may be palpable as 1 or more cylindrical swellings beneath the areola and visible as blue cystic structures on dissection.[2] Although it is believed by some that stagnation of secretions and dilatation of mammary ducts are the primary changes that develop in the breast, the syndrome is also termed periductal mastitis because of the alternate theory that inflammation precedes and causes ectasia.[3] Duct ectasia or periductal mastitis is the primary pathologic feature in 4.2 to 5% of surgically treated mammary diseases in humans.[4,5] It is even more common as an incidental finding,[6] particularly in postmenopausal women.[7] It has been proposed that lactation and pregnancy may be contributing factors in the development of duct ectasia, and prolactin concentrations may be increased in some instances.[8] However, in 1 study,[3] neither parity nor lactation history correlated with the prevalence of duct ectasia; this condition is also diagnosed in nulliparous women and, rarely, in infants or men.[2]

Veterinary pathologists recognize mammary duct ectasia as a nonneoplastic cause of mammary enlargement in dogs, yet there is little published information on this syndrome.[9-11] Progestagens reportedly may induce duct ectasia; the lesion may regress spontaneously and is reportedly cured by ovariectomy.[9] Recognition of duct ectasia in spayed bitches with no history of progestagen treatment prompted us to hypothesize that mammary duct ectasia may develop independently of ovarian or exogenous progestagens and may not respond to ovariectomy. The purpose of the study reported here was to characterize the signalment, history, clinicopathologic findings, and outcome of dogs with mammary duct ectasia.

Criteria for Selection of Cases

Information regarding history, age, sex, breed, and clinical findings was retrieved from veterinarians that had submitted mammary biopsy specimens obtained from dogs to the **Veterinary Medical Diagnostic Laboratory (VMDL)** at the University of Missouri between Jan 1, 1992, and Dec 31, 1999. Data obtained from examination of histologic sections and referring veterinarians were evaluated for all dogs in which mammary duct ectasia was diagnosed.

Procedures

One pathologist reviewed all microscopic slides to verify the diagnosis of mammary duct ectasia and to exclude dogs that had concurrent neoplasia. Surveys were sent to veterinarians who had submitted biopsy specimens to the VMDL, and information regarding body condition, reproductive history (date of ovariohysterectomy, parity, date of last whelping and weaning), history of hormonal treatment, number and location of affected mammary glands, clinical and gross appearance of lesions, extent of surgical excision (lumpectomy or mastectomy), any nonsurgical treat-

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ment, and evidence of recurrence or development of mammary neoplasia was requested. Veterinarians who did not respond to surveys were contacted by telephone.

Statistical analyses—The proportion of cases comprised by each breed of dog was compared with the proportion of that breed in the population (ie, all dogs from which samples were submitted to the VMDL during the study period) by use of the *z* score. Results were considered significant at $P < 0.05$; results are reported as mean ± SD, unless otherwise indicated.

Results

Information regarding 69 dogs with mammary duct ectasia was initially reviewed; 18 dogs were excluded because of concurrent mammary adenocarcinoma. Duct ectasia was, therefore, the primary diagnosis for 51 mammary biopsy specimens and comprised 0.15% (33,826) of all canine biopsy specimens, 2.8% (1,825) of all canine mammary biopsy specimens, and 48.1% (106) of all canine nonneoplastic mammary biopsy specimens during the 8-year period. Referring veterinarians for 40 of the 51 (78.4%) dogs provided additional information in response to the survey.

Dogs with duct ectasia were evenly distributed over an age range of 1 to 13 years (mean, 6.1 ± 3.1 years; median, 6 years). All dogs with mammary duct ectasia were female; 20 (39%) had been spayed before mammary biopsy was performed. The interval between ovariohysterectomy and diagnosis of duct ectasia was reported for 13 of these dogs; 5 were spayed within 6 months preceding the biopsy procedure, and 8 were spayed at least 1 year before the biopsy procedure. Mean age at ovariohysterectomy for these 13 dogs was 5.1 ± 3.1 years (median, 5 years; range, 0.5 to 10 years; **Fig 1**). Mean duration of duct ectasia at the time of biopsy (estimated by the referring veterinarian in 33 of 51 dogs) was 1.5 months (range, < 1 week to 6 months). There was no apparent correlation between duration of duct ectasia and postovariohysterectomy interval. Eleven dogs that were spayed because of duct ectasia on the date of the biopsy procedure were classified as sexually intact for this study.

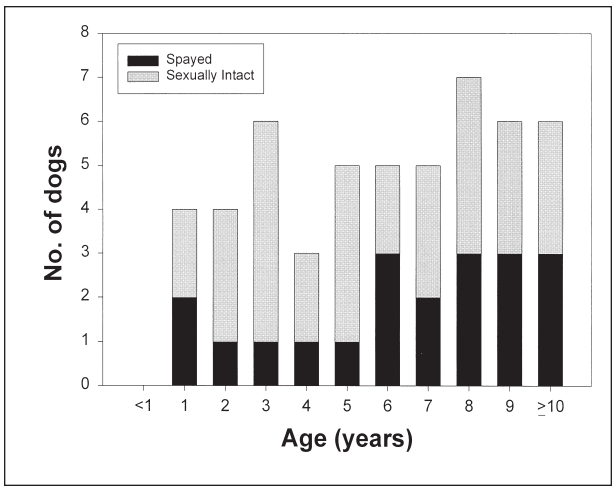

Figure 1—Age distribution of 51 dogs with mammary duct ectasia.

Reproductive history was reported for 26 dogs: 16 of these dogs had never whelped; 5 had had 1 litter; and 5 had had multiple litters. Dates of the most recent whelping and weaning were known for 8 dogs: 3 had last whelped > 1 year before duct ectasia was diagnosed; 2 had whelped 6 to 8 months before duct ectasia was diagnosed; and 3 had whelped 2 to 3 months and had weaned pups 1 to 6 weeks before duct ectasia was diagnosed.

Mammary duct ectasia was diagnosed in 30 breeds, including mixed-breed dogs. The following breeds accounted for at least 2 instances of duct ectasia and had significantly greater than the expected number of cases: Great Dane (5 dogs), Chihuahua (3), English Springer Spaniel (3), and Miniature Pinscher (2).

Mean body weight of dogs with duct ectasia was 20.1 ± 14.7 kg (44.2 ± 32.3 lb; median, 20.3 kg [44.7 lb]; range, 1.4 to 58.6 kg [3.1 to 128.9 lb]). Insufficient data on body condition were received for analysis.

The referring veterinarians usually interpreted mammary enlargement in dogs with duct ectasia as 1 or more masses, tumors, or nodules (26 dogs). In 1 of these 26 dogs, the lesion was described as cylindrical. In another, the dog reportedly vocalized and had signs of pain on palpation of the affected gland. In a third dog, the nodules were described as blue. In 13 dogs, the cystic nature of duct ectasia was appreciated clinically or at surgery. One referring veterinarian reported

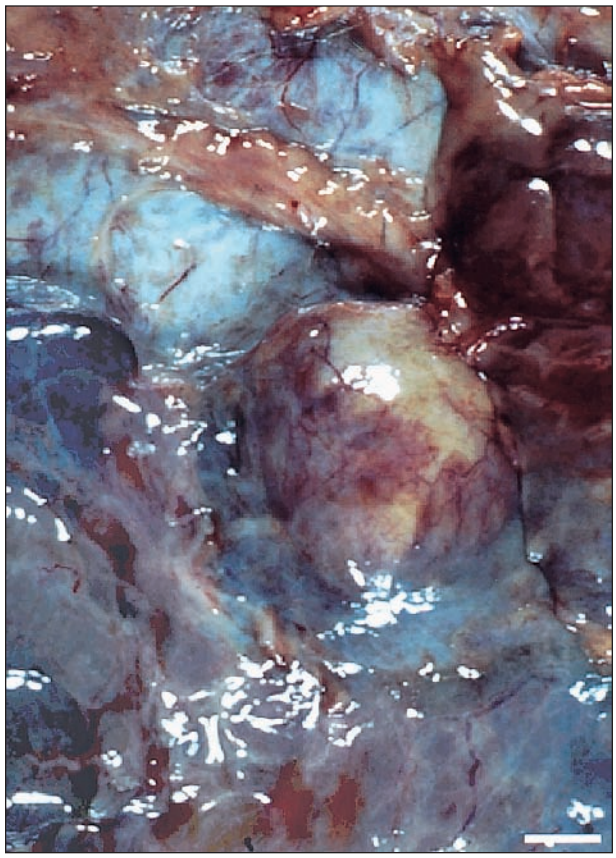

Figure 2—Mammary duct ectasia lesions in a 1-year-old sexually intact female Great Dane with skin overlying the mammary gland removed. Secretions (yellow and blue) distend ducts into saccular or cylindrical shapes. Bar = 1 cm.

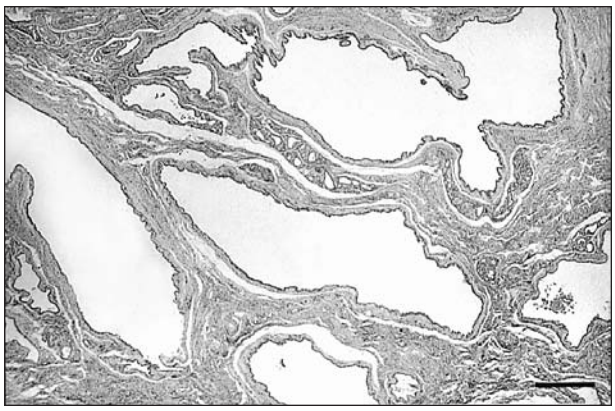

Figure 3—Photomicrograph of a section of mammary tissue from a dog with mammary duct ectasia. Dilatated ducts appear as empty spaces lined by typical epithelium. Neither hyperplasia nor inflammation is evident. H&E stain; bar = 1 mm.

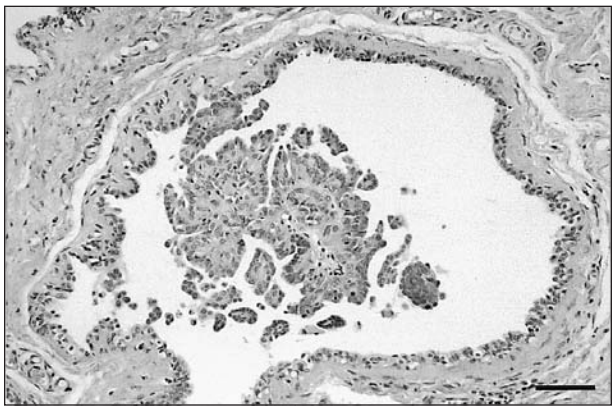

Figure 4—Photomicrograph of a section of mammary tissue from a dog with mammary duct ectasia and epithelial proliferation. Papillary projections lined by hyperplastic epithelium extend into lumen of the duct. H&E stain; bar = 100 μm.

that the affected gland had enlarged during estrus; others reported development of the lesion in 4 dogs during exaggerated pseudocyesis. In 1 dog that we examined at necropsy (death unrelated to duct ectasia), cystic ducts were palpable and visible beneath the skin. The ectatic ducts were cylindrical or saccular and filled with yellow or bluish inspissated secretion (**Fig 2**).

The number of affected mammary glands was reported for 47 dogs. Duct ectasia affected only 1 gland in 36 dogs, 2 glands in 6 dogs, and 3 or more glands in 5 dogs. Site was specified as cranial mammary glands (numbers 1 or 2) in 14 dogs; middle mammary glands (number 3) in 10; and caudal mammary glands (numbers 4 or 5) in 31.

All dogs were treated by excision of the affected glands; 11 dogs were spayed at the same time as excision. In 9 dogs, the entire affected gland or glands were removed. In 11 dogs, only abnormal tissue was removed (lumpectomy). The extent of excision was not reported for the remaining dogs. Nonsurgical treatment was not reported for any dog.

One dog that underwent surgery for removal of ectatic tissue had a mammary adenocarcinoma in a different gland 4 years previously but was not currently or subsequently affected by mammary neoplasia. Clinical history of mastitis was not reported for any dog, and no dog had a history of progestagen administration.

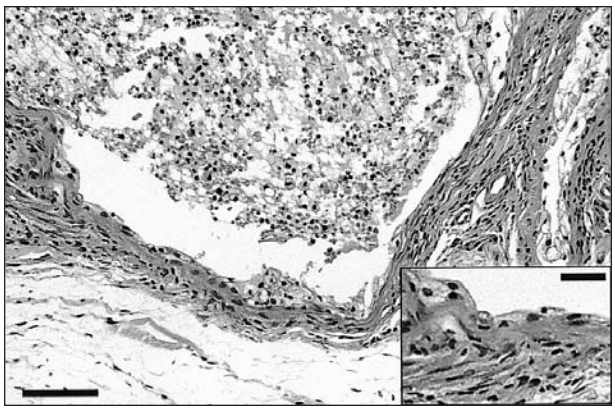

Figure 5—Photomicrograph of a section of mammary tissue from a dog with mammary duct ectasia and mastitis. A dilatated duct is partially filled by neutrophils and macrophages. H&E stain; bar = 100 μm. Inset—Ductal epithelium is eroded, and the lumen is lined by foamy macrophages instead of epithelial cells. Bar = 35 μm.

Histologically, duct ectasia was characterized by dilatation of major ducts, with affected ducts ranging from 500 μm to 2.5 cm in diameter (**Fig 3**). One or 2 layers of columnar epithelial cells typically lined the ectatic ducts, but areas of epithelial hyperplasia were also observed (**Fig 4**). Of 51 dogs, 17 had focal loss of duct epithelial cell polarity; an additional 9 dogs had this feature only in areas of duct epithelial erosion. Twenty-three dogs had focal epithelial stratification (more than 2 cell layers); an additional 11 dogs had stratification only adjacent to areas of erosion. Thirty-seven dogs had papillary proliferation of ductal epithelium, 11 had solid proliferation, 11 had cholesterol granulomas around ectatic ducts, 9 had atypical ductal epithelium, and 8 had squamous metaplasia of ductal epithelium. Thirty-six dogs had mastitis (predominantly lymphocytic) in glands with duct ectasia (**Fig 5**); an additional 2 dogs had inflammation only in areas of epithelial erosion. Mammary acini were considered hyperplastic in 23 dogs, inactive or atrophied in 24, and active (secretory) in 4. A correlation between signalment of the patient and histologic features was not evident.

Thirty-six dogs received follow-up care by referring veterinarians for 3 months to 7 years (mean, 3.2 years) after surgery for duct ectasia. These veterinarians reported recurrence and excision of a similar mammary lesion in 3 dogs after the initial biopsy procedure, but no further histologic evaluation was performed. In the remaining dogs, there was no apparent recurrence of duct ectasia, but 1 dog developed a solid carcinoma in the same gland 6 months after surgery for duct ectasia.

Discussion

Duct ectasia was the primary lesion in nearly 3% of surgically treated mammary diseases in dogs and comprised almost half of nonneoplastic mammary diseases. Ectatic lesions were detected in involuting, nonlactating, or hyperplastic glands in nulliparous, parous, and spayed bitches; however, no ectatic lesions were detect-

ed in male dogs. Great Danes, Chihuahuas, English Springer Spaniels, and Miniature Pinschers appeared to be overrepresented. The prevalence of duct ectasia was rather evenly distributed over a wide range of ages.

Although it has been reported that administration of progestagens may induce mammary duct ectasia and ovariectomy may cure mammary duct ectasia in dogs,[9] 39% of the dogs in our study had been spayed before duct ectasia was diagnosed, and none had been treated with progestagens. Increased serum prolactin concentrations have been detected in some human patients with duct ectasia.[8] In 1 report, 10 of 12 dogs with mammary dysplasia (including duct ectasia) had an increased proportion of prolactin-positive hypophyseal cells detected by use of immunohistochemistry; all 12 dogs had an increased proportion of cells in which growth hormone was detected.[12] Only 2 of 11 dogs with mammary dysplasia had increased serum prolactin concentration, whereas 9 of 11 of these dogs had minimal to considerable increases of serum growth hormone concentrations.[12] In our study, pituitary glands were not examined, and serum hormone concentrations were not determined. Onset of duct ectasia 1 to 2 weeks after weaning in 2 dogs in this study suggests that ducts in the involuting mammary gland may be prone to dilatation and accumulation of inspissated secretions. However, regarding duct ectasia in humans, neither pregnancy nor lactation appears to be essential to development of the lesion.[3,13]

Mammary duct ectasia in dogs resembles that in humans regarding gross and histologic appearance, variable age at onset, and inconsistent association with pregnancy or lactation. In 2 reports, duct ectasia was the primary pathologic finding in 5 to 12% of women treated by mammary surgery.[4,5] Both glands were affected in 29% of women[5]; at least 22% of the dogs in our study had involvement of > 1 gland. Duct ectasia is not considered preneoplastic in women.[7] In our study, only 2 dogs had any history of mammary neoplasia, and only 1 of these dogs developed mammary carcinoma subsequent to mammary duct ectasia during the 8-year study. This is not considered different from the estimated annual incidence of 198.8 cases of mammary neoplasia per 100,000 female dogs,[14] especially in light of the likely promotional effects of not spaying (31 of 51 dogs) or spaying after the first or second estrus (at least 11 of 20 dogs), as seen in the dogs of our study.[15] We cannot exclude the possibility that duct ectasia preceded neoplastic transformation in the 18 dogs with mammary neoplasia (that were excluded from this study) in which a diagnosis of duct ectasia was also made. However, in the 51 dogs in which duct ectasia was the primary diagnosis, there was no apparent increased risk for subsequent development of mammary neoplasia.

Some clinical differences between mammary duct ectasia in humans and dogs are evident. Forty-one to 45% of human patients had discharge from the nipple of affected glands[1,4,5]; discharge was not reported in any of the dogs in our study. Most women with duct ectasia reported pain[1]; evidence of pain (vocalization on palpation) was reported for only 1 of our dogs. Some investigators consider duct ectasia to be secondary to periductal mastitis in women and have reported that periductal inflammation predominates over ductal dilatation in younger patients.[2] Although mastitis was common in our dogs, the presence of mastitis did not correlate with age, and no veterinarian reported a clinical history of mastitis before onset of duct ectasia. Thus, we have no evidence in these dogs to support the theory that duct ectasia is a sequel to periductal mastitis.

Interestingly, cysts were palpable in 13 of 51 dogs with mammary duct ectasia, and in 2 other dogs, in which lesions were interpreted as nodules or masses, bluish discoloration or cylindrical shape was evident. These findings should increase suspicion of duct ectasia, but cysts may also develop in mammary tumors, and duct ectasia may coexist with mammary neoplasia. Pathologists should review multiple sections of biopsy specimens in instances of duct ectasia to rule out the possibility that intraductal neoplasia is the cause for dilatated ducts.

Duct ectasia apparently seldom recurs after excision. In a study of 51 humans, a quarter of patients required additional surgery after the initial operation; however, those surgeries (for all but 1 who was treated by mastectomy) consisted only of excisional biopsy or formal duct excision.[5] Among our dogs, at least 9 of 51 were treated by mastectomy.

Results of our study reveal that duct ectasia may cause cystic enlargement of 1 or more mammary glands in spayed or intact bitches in a wide range of ages and is a major nonneoplastic cause for mammary surgery. Mammary duct ectasia may not be prevented or resolved by ovariohysterectomy and may develop independent of ovarian or exogenous progestagens. Although duct ectasia may coexist with mammary neoplasia, we found no evidence that duct ectasia, per se, predisposes a dog to mammary neoplasia. Excision of the lesion is usually curative. Confirmation of the diagnosis by performing a biopsy has the added advantage of excluding the possibility of mammary neoplasia.

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Correction: Comparison of the effects of morphine administered by constant-rate intravenous infusion or intermittent intramuscular injection in dogs

Conversions for 2 dosages in the article "Comparison of the effects of morphine administered by constant-rate intravenous infusion or intermittent intramuscular injection in dogs" (*J Am Vet Med Assoc*, Mar 15, 2001, pp 884–891) are incorrect. The dosages are given in the first full paragraph in the left-hand column on page 889. The sentence should read, "In previous studies, administration of morphine to dogs at a dosage of 10 mg/kg (0.45 mg/lb), SC,[14] or 3 mg/kg/h (1.4 mg/lb/h), IV,[15] caused body temperature to decrease from 39 C to 36 C (102.2 to 96.8 F) within 4 hours, while respiratory rate increased.