NOTE *Pathology*

Ovarian Teratoma with a Formed Lens and Nonsuppurative Inflammation in an Old Dog

Yoko YAMAGUCHI[1)], Tsuneo SATO[1)], Hisashi SHIBUYA[1)], Shigehisa TSUMAGARI[2)] and Takayuki SUZUKI[3)]

[1)]Departments of Veterinary Pathology, [2)]Theriogenology, College of Bioresourse Sciences, Nihon University, 1866 Kameino, Fujisawa, Kanagawa 252–8510 and [3)]Bellvet Animal Hospital, 3–14–21 Kamiyouga, Setagaya-ku, Tokyo 158–0098, Japan

(Received 3 June 2003/Accepted 9 February 2004)

ABSTRACT. A 9-year, 7-month-old female German shepherd weighing 26.6 kg was admitted to the hospital for pica and diarrhea. A large mass was found in the right ovary and removed, and cross section of the mass revealed a multilobular tumor consisting of several cystic cavities which contained tufts of dark hair in thick creamy-white sebaceous fluid. Histologically, the tumor consisted of adipose tissue, central nervous tissue, crystalline lens, cartilage and bone. In the central nervous tissue, lens and lesions like nonsuppurati ve inflammation comprizing of accumulation of glial cells and lymphocytic perivascular cuffing were observed. The tumor was diagnosed as a mature cystic teratoma.

KEY WORDS: canine, ovary, teratoma.

J. Vet. Med. Sci. 66(7): 861–864, 2004

Teratomas in the ovary are neoplasmas composed of multiple tissues arising from more than one germ cell layer of ectodermal, mesodermal, endodermal origin, and any combination thereof, representing any organ, except the part in which they arise [1, 4, 5, 7, 9, 11–13, 15–17, 25]. They are classified as germ-cell tumors of ovarian tumors. Spontaneous teratomas are rare in all species, except man and the horse [10, 12, 17, 20, 25]. Although other ovarian neoplasmas are identified in aged animals, teratomas are most commonly found in young animals [13, 25], and the great majority of animals are under six years old [9, 11, 13, 15, 18, 25]. This report describes an ovarian teratoma in an old dog comprizing of scarce histological components.

A 9-year, 7-month-old female German shepherd weighing 26.6 kg was observed pica and diarrhea for about 3 weeks before examination. The bitch had no past illnesses, and had a history of confinement 4 years before. She was syntexis but her condition was not bad. Her abdomen was not appeared distended, but physical examination revealed a firm, less moveable, painless, lemon-sized palpable mass in the abdominal cavity.

Abdominal radiograms showed an ovoid mass in the center of the abdomen. Dislocation of the intestinal gas occurred due to suppression by the mass. But no passage disorder was found. Abdominal ultrasonographs showed the mass was composed of parenchyma in size of about 7.4 $\times$ 6.0 cm.

Exploratory laparotomy revealed an ovoid mass in the right ovary. The mass was surgically removed, and at the same time, an ovariohysterectomy was performed also. The mass weighed 109 g and measured 7.4 $\times$ 6.0 cm. It was pedunculated, being connected to the right ovary by a pedicle 1.5 cm in diameter. The mass was smooth, thinly encapsuled and had a slightly lobulated surface which was mottled grayish white, yellowish brown and black. The cross section was multilobular and consisted of several small and large cystic cavities which contained tufts of dark hair in thick creamy-white sebaceous fluid (Fig. 1). On the left ovary, a 1.0 $\times$ 1.5 cm white cyst was found.

The mass was fixed in 10% buffered formalin, embedded in paraffin, sectioned at 3 μm, and stained with hematoxylin and eosin (HE), masson's trichrome (MT), toluidine blue(TB), alcian blue and periodic acid/schiff reaction (AB-PAS), Kluver-Barrera method for myelin and nerve cells (K-B). Immunohistochemical technique was applied to the paraffin-embedded sections with anti-keratin/cytokeratin polyclonal, anti-vimentin monoclonal and anti-S-100 protein polyclonal (NICHIREI Co) antibodies.

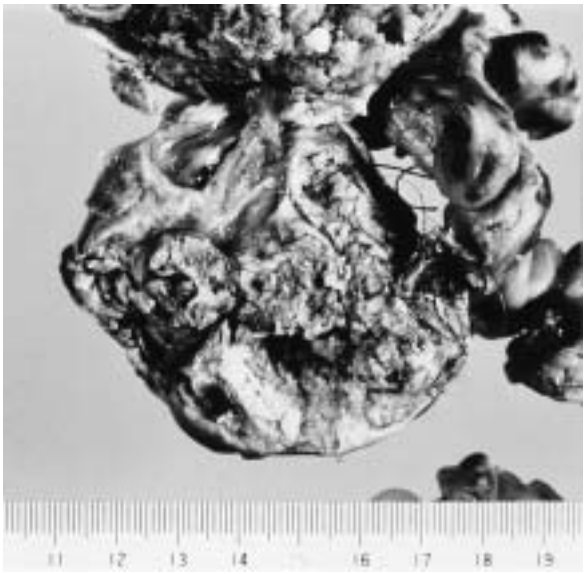

Fig. 1. The cross section of the mass is multilobular and consists of several small and large cystic cavities which contain masses of hair in thick, creamy sebaceous fluid.

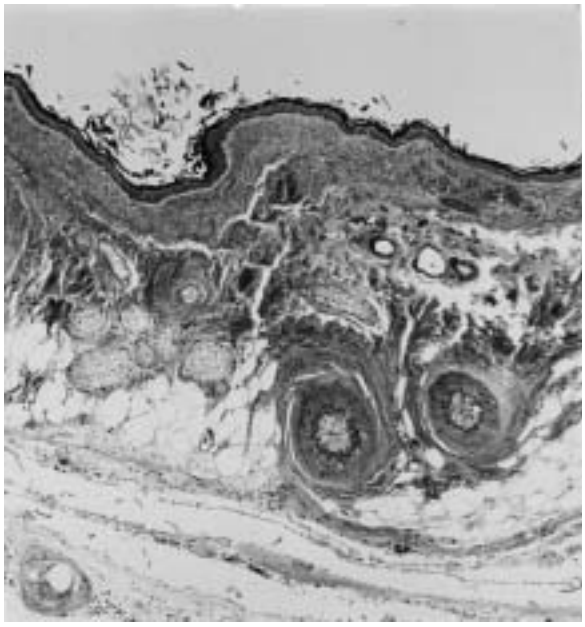

Fig. 2. The wall of the cysts are lined by well-differentiated cutaneous tissue. Dermis containing sebaceous glands and hair follicles, as well as adipose tissue are also observed. HE stain, × 60.

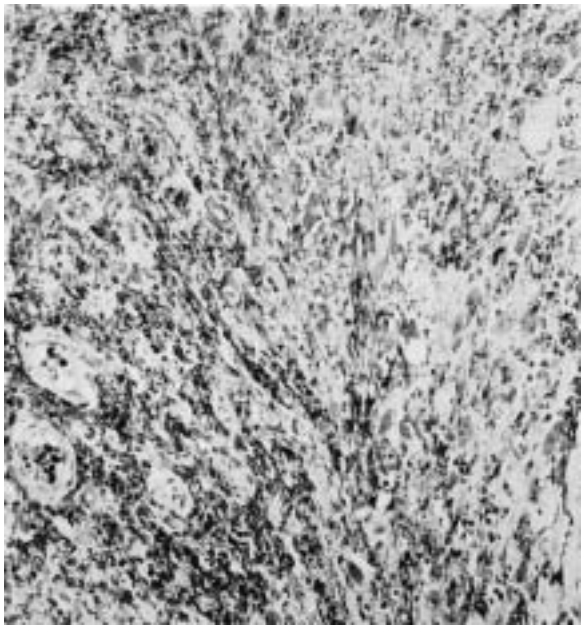

Fig. 3. The loss of myelin sheath is shown on the right side of the figure. Kluver-Barrera stain, × 150.

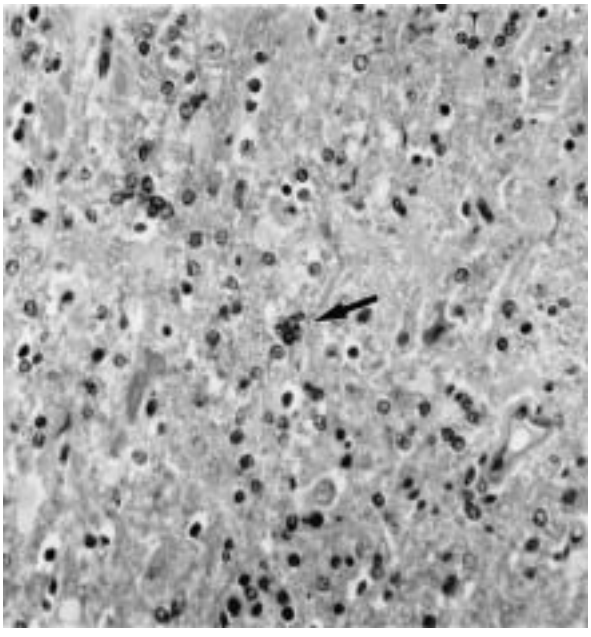

Fig. 4. In the central nervous tissue, there is numerous neuroglia. An accumulation of the glial cells can be seen in the center of the figure (arrows). HE stain, × 300.

Histologically, the walls of these cysts were lined by well-differentiated skin. It consisted of keratinizing, stratified, squamous epithelium, pricklecell layer and basal layer. Some parts of the epidermis contained numerous melanocytes (Fig. 2). In the dermis there were occasionally fibroblasts, sebaceous glands, hair follicles, apocrine sweat glands and feeder blood vessels, and myelinated and non-myelinated peripheral nerves. Also, the tumor contained adipose tissue, central nerve tissue, bone, cartilage, lymphoid nodules, gland structures and choroids plexus. The gland structure located beside the cartilage was granular, showing positive reaction for periodic acid-Schiff within its simple cuboidal epithelium and in the duct. Mast cells were often observed in the adipose tissue, and showed metachromasia with toluidine blue stain. In the central nervous tissue, there were numerous nerve cells and glial cells. There were some nerve cells containing lipofuscin granules in the cytoplasm. Areas similar to loss of myelin, occasional patches 4 to 5 glial cells, lymphocytic perivascular cuffing were also observed throughout the central nervous tissue (Figs. 3, 4, 5). Ovoid homogeneous lamellar structures were often recognized in central nervous tissue (Fig. 6) and stained similar to normal crystalline lens. There was neither intestinal nor respiratory epithelium in the mass. In the epithelial tissues like epidermis, appendages of the skin including sebaceous glands, hair follicles, apocrine sweat glands and gland structures were positive for anti-keratin/cytokeratin. Mesenchymal tissues were positive for anti-vimentin. The tissues including neuroglia, schwann cells of myelinated peripheral nerves, chondrocytes and melanocytes were positive for anti-S-100 protein. It can be said that the neoplastic tissues could be stained almost as same as normal tissues. The pedicle connecting the mass and the right ovary consisted of abundant vascularity and components of the ovary. Many feeder vessels were seen at the center of the stem, around which there was compressed ovary tissue con-

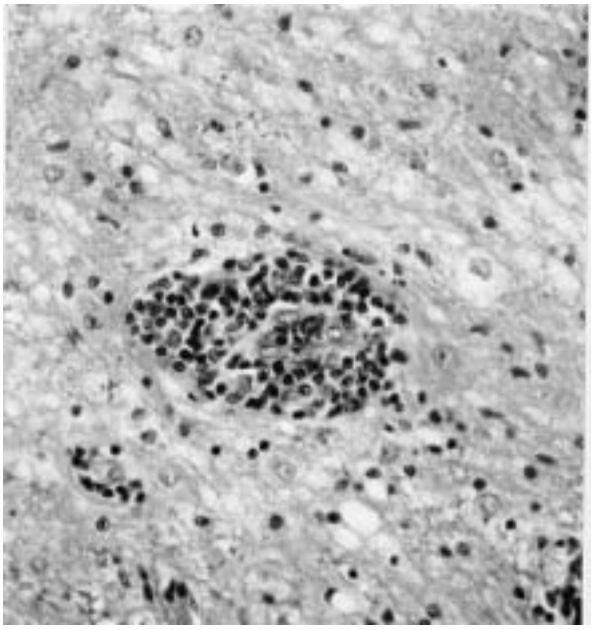

Fig. 5. Lymphoid cells are gathered around the vasculature of the central nervous tissue. HE stain, × 300.

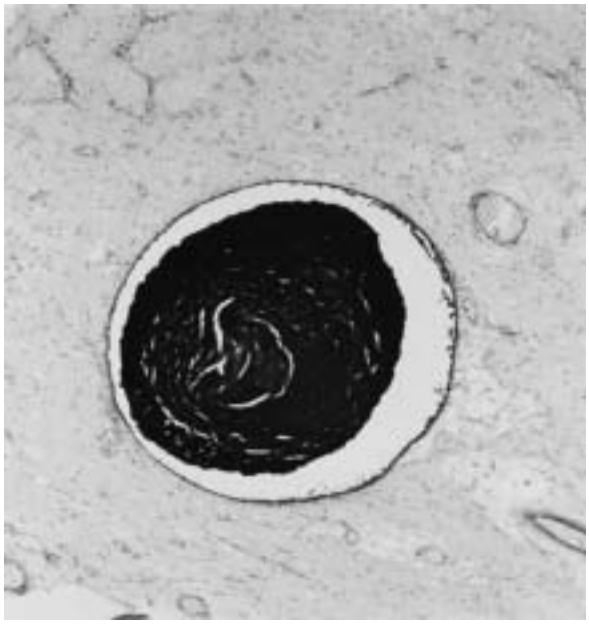

Fig. 6. An ovoid homogeneous lamellar structure is observed in the central nervous tissue. Alcian blue-PAS stain, × 60.

taining a lot of follicles. The white cyst on the left ovary consisted of a thin layer of connective tissue. The right ovary where the mass arose from was normal. The contralateral ovary was also normal.

As the mass consisted of much cystic tissue and the stroma was well differentiated, it was diagnosed as cystic teratoma derived from the right ovary. The tumor was composed of two germ cell layers of ectoderm and mesoderm, because no endodermal tissues of the intestinal or respiratory epithelium were observed. Teratomas in animals, in contrast to those in humans, are almost all benign [4, 12, 17]. As the tissues of this tumor were well differentiated, and there were no immature or malignant components, the ovarian teratoma in this case could be considered to be benign. In the part of central nervous tissue, there were areas suggesting nonsuppurative inflammation which have not been reported in animals. The ovoid homogeneous lamellar structures recognized in the central nervous tissue were considered to be a crystalline lens. There was a human case of a sacrococcygeal teratoma with a completely formed eye in 29 weeks-infants, but there have been no papers reporting crystalline lens in canine teratomas [23]. However, it is sufficiently possible to being differentiated for optic that the optic structures can be differentiated from the tumor cells when considered their multipotential nature. The white cyst of the left ovary was considered to be non-neoplastic because it lacked atypism or proliferative figures. According to the WHO histological classification, teratoma in females is divided into immature teratoma and mature teratoma based on the cellular morphology of the tumor. There is occasionally a type of differentiation that is purely or mostly monodermal. Mature teratoma can be cystic or solid. Cystic ones are further subdivided into dermoid cyst (mature cystic teratoma) and dermoid cyst with malignant transformation [22]. According to the WHO histological classification in domestic animals, teratomas are categorized as a germ cell tumor. Although animal teratomas have been described to be mature, immature, cystic or solid [12], detailed classification has not been established. The present case was diagnosed as mature cystic teratoma, and this is the most frequent type of teratoma in dogs [5]. Greenlee and Patnaik have reported a teratoma on the right ovary of a 9-year-old German shepherd [9, 20], similar to our case, but it was malignant teratoma, because metastases were noted. Comparing the rate of occurrence of teratoma in different breeds of dog, mongrels have a high incidence, and German shepherds follow them [1, 2, 4, 5, 7–11, 14, 16, 19–21, 24, 25]. It has been reported that German shepherds have a higher prevalence of ovarian neoplasma than other breeds [18]. Teratoma seems to occur more frequently on the left side [1, 4, 5, 7, 9–11, 16, 20, 21, 24, 25], while such predilection has not been reported in women, though [9]. In an examination of 63 cases of canine ovarian tumors by Cotchin including adenoma, adenocarcinoma, granulosa-cell tumor, and seminoma, it was revealed that the tumors, except for seminoma, occurred more frequently on the left ovary than the right [6]. It has been suggested that generally ovarian tumors have predilection for the left ovary, but the reason remains unknown. Teratoma has been reported in dogs ranging in age from 6 weeks to 11 years, and the median age was 3.5 years [1, 2, 4, 5, 7–11, 16, 19–21, 24, 25]. Although our case of a 9-year, 7-month-old dog was relatively older than the median age, it is possible that years passed without clinical signs until the mass became large

enough to suppress the intestine and cause of pica and diarrhea. However, she had parturition with no disorder at the age of six, so it is highly suspected that the tumor occurred after that. Surgery remains the mainstay of treatment for teratoma [3, 13]. The dog was still alive showing no clinical recurrence of the tumor 1 year and 2 months after the surgical removal. In regard to nonsuppurative inflammation - like lesions in the central nervous tissue, two hypotheses are possible: one is that it was inflammatory reaction against the tumor by normal inflammatory cells: the other is that it was inflammatory reaction imitated by neoplastic inflammatory cells derived from the tumor. Further study of significance and mechanism of this inflammatory reaction are needed.

REFERENCES

1. Akiyama, T., Suekami, K., Kimura, T., Tochimura, H., Fujino, K. and Uno, K. J. *Amim. Res. Found.* **3**: 21–24 (in Japanese).
2. Alexander, R.W. 1981. *Vet. Rec.* **109**: 521–522.
3. Barrett, R.E. and Theilen, G.H. 1977. pp. 1263–1267. *In*: Current Veterinary Therapy IV Small Animal Practice (Robert W. K. ed.), W.B. Saunders Company.
4. Britt, J.O. and Howard, B.E. 1981. *Canine Pract.* **8**: 41–44.
5. Clayton, H.M. 1975. *Vet. Rec*. **96**: 567–568.
6. Cotchin, E. 1961. *Res. Vet. Sci*. **2**: 133–142.
7. Crane, S.W., Slocum, B., Hoover, E.A. and Wilson, G.P. 1975. *J. Am. Vet. Med. Assoc.* **167**: 72–74.
8. Dehner, L.P., Norris, H.J., Garner, F.M. and Taylor, H.B. 1970. *J. Comp. Pathol*. **80**: 299–306.
9. Greenlee, P.G. and Patnaik, A.K. 1985. *Vet. Pathol*. **22**: 117–122.
10. Gruys, E. and Van Dijk, J.E. 1976. *Vet. Pathol*. **13**: 455–459.
11. Jergens, A.E., Knapp, D.W. and Shaw, D.P. 1987. *J. Am. Vet. Med. Assoc*. **191**: 81–83.
12. Kennedy, P.C., Cullen, J.M., Edwards, J.F., Goldschmidt, M.H., Larsen, S., Munson, L. and Nielsen, S. 1998. Histological classification of Tumors of the Genital System of the Domestic Animals (Second Series Volume IV), The Armed Forces of Pathology, Washington, D. C.
13. Klein, M.K. 1989. pp. 347–355. *In*: Clinical Veterinary Oncology, 2nd ed. (Stephen, J., Withrow, E. and Gregory MacEwen. eds.), J.B. Lippincott Company.
14. Lambrechts, N.E. and Pearson, J. 2001. *J. S. Afr. Vet. Assoc.* **72**: 49–51.
15. McEntee, K. 1990. pp. 69–93. *In*: Reproductive Pathology of Domestic Mammals, Academic Press, Inc., San Diego.
16. Nagashima, Y., Hoshi, K., Tanaka, R., Shibazaki, A., Fujisawa, K., Konno, K., Machida, N. and Yamane, Y. 2000. *J. Vet. Med. Sci.* **62**: 793–795.
17. Nielsen, S.W. and Kennedy P.C. 1990. pp. 479–517. *In*: Tumors in Domestic Animals 3rd ed. (Mouton, J. E. ed.), Univ. California Press, Berkeley.
18. Patnaik, A.K. and Greenlee, P.G. 1987. *Vet. Pathol.* **24**: 509–514.
19. Patnaik, A.K. and Nafe, L.A. 1980. *Vet. Pathol.* **17**: 764–769.
20. Patnaik, A.K., Schaer, M., Parks, J. and Liu, S.-K. 1976. *J. Small Anim. Pract.* **1784**: 235 –246.
21. Riser, W.H., Marcus, J.F., Guibor, E.C. and Oldt, C.C. 1959. *J. Am. Vet. Med. Assoc.* **134**: 27–28.
22. Scully, R.E. 1999. Histological Typing of Ovarian Tumours, 2nd ed., Springer Verlag Berlin Heidelberg New York.
23. Sergi C., Ehemann, V., Beedgen, B., Linderkamp, O. and Otto, H.F. 1999. *Pediatr. Dev. Pathol.* **2**: 50–57.
24. Storm, R.E. 1947. *North Am. Vet.* **28**: 30–31.
25. Wilson, R.B., Cave, J.S., Copeland, J.S. and Onks, J. 1985. *J. Am. Anim. Hosp. Assoc.* **21**: 249–253.