Ovarian teratoma in a bitch

S. A. HEADLEY, E. J. FUCK, E. T. FUCK, C. E. CURTI

PRIMARY ovarian tumours are very rare in domestic animals (Sforna and others 2003); they may be of epithelial, germ cell, stromal sex cord or mesenchymal origin (Nielsen and Kennedy 1990, Kennedy and Miller 1993, Sforna and others 2003). Teratomas are rare tumours composed of structures derived from multiple embryonic germ cells (ectoderm, endoderm or mesoderm) that may occur within any organ (Nielsen and Kennedy 1990, Kennedy and Miller 1993). Most teratomas described in animals have been intragonadal (Basaraba and others 1998, Toyosawa and others 2000, Miyoshi and others 2001, Sato and others 2003), but extragonadal teratomas have also been reported (Williams and others 2001, Gurfield and Benirschike 2003).

There are few descriptions of teratoma within the veterinary literature; cases are more widely described in human medicine. Among the domestic animal species, teratomas have been more frequently described in horses, and are considered extremely rare in other animals (Nielsen and Kennedy 1990, Kennedy and Miller 1993). Teratomas constitute almost 2 per cent of all primary canine ovarian tumours (Sforna and others 2003). Recently, cases of teratoma have been described in cats (Basaraba and others 1998, Sato and others 2003), dogs (Nagashima and others 2000, Yamaguchi and others 2004), African clawed frogs (*Xenopus laevis*) (Cheong and others 2000), domestic ferrets (Williams and others 2001), and a cynomolgus monkey (Toyosawa and others 2000).

This short communication describes the ultrasonographic, gross and microscopic features of a teratoma in a bitch.

A two-year-old German shepherd bitch weighing 28·6 kg was admitted to the SOS Animal veterinary hospital in late September 2004, with a history of sudden reduction of physical activity, lethargy and a marked increase in the size of the abdomen. The owner reported that he had noticed an unusual increase in the size of the dog's abdomen almost one year previously, but since there was no apparent discomfort and the animal maintained its routine activities, veterinary advice had not been sought. The owner stated that the size of the dog's abdomen had become remarkably enlarged during the 30 to 40 days before presentation to the hospital. The dog was an active participant in, and a winner of, various sporting competitions.

Physical examination of the dog on arrival at the hospital was unremarkable; the animal was extremely active and its respiratory and cardiac functions were considered normal. Biochemical evaluations revealed a mild increase in the serum urea (14·28 mmol/l, reference range 3·14 to 9·24 mmol/l) and alanine aminotransferase (42 iu/l, reference range 0 to 40 iu/l) values. Palpation revealed a large abdominal mass located in the region of the right ovary. Ultrasonographic examination revealed a large, heterogenous, cystic, echogenic, rounded mass, which occupied the entire dorsal right-sided region of the abdominal cavity (Fig 1).

An exploratory laparotomy revealed a large, firm, solid mass that replaced the right ovary; the left ovary was grossly normal. The mass caused a displacement of the intestines and other abdominal organs. An ovariohysterectomy was performed. The animal recovered, and at the time of writing was healthy and had resumed its sporting activities. The tumour was fixed in 10 per cent formalin solution and processed for routine histopathological evaluation.

The mass weighed 3·3 kg and was 22 cm in diameter. Grossly, the tumour was encapsulated and firm; its surface was predominantly smooth and glistening, slightly irregular and cream to white in colour. Cross-section of the mass revealed an irregular surface that was predominantly covered by haired skin and cystic areas (Fig 2). These irregular, undulating, variably sized (1·5 to 2·5 cm in diameter), communicating cystic areas contained a watery to viscous, straw-coloured fluid. The cystic structures were embedded in a white to opaque, extensive interconnecting mass that consisted of a mixture of soft and firm connective tissue. Careful gross examination of the mass revealed apparently no ovarian tissue.

Histologically, there was a marked variety of tissues within the tumour, each part of the tumour that was examined revealed a somewhat different histological architecture. Basically, the tumour was composed of a mixture of various embryonic tissues and cystic structures embedded in a muscular background. The outer margin of the tumour was lined by a squamous epithelium that demonstrated degenerative alterations, and all constituents of a normal cutaneous membrane (Fig 3a). Most of the large cystic areas were irregular in shape, filled with keratin and demarcated by a stratified squamous, keratinised epithelium, with hair follicles and sebaceous glands (Fig 3b). Smaller cystic areas were lined only by a stratified squamous epithelium without adnexal structures. The solid part of the tumour consisted of a large, dense sheet of a mixture of irregularly orientated smooth and skeletal muscle fibres and adipose tissue. Within the matrix of connective tissue there were islands of cartilaginous tissue, blood vessels and nerve fibres that were well differentiated but arranged in an ill-defined pattern (Fig 3c). In another area, a small cystic structure was lined by layers of plump, melanin-filled cells, probably representing elements originally from the neural crest (Fig 3d). Various glandular structures, comparable to those observed in the submucosa of the normal intestine, were observed surrounded by smooth muscle (Fig 3e). A large, extensive band of nervous parenchyma with prominent neurons, oligodendrocytes and astrocytes was also observed embedded within the muscular tissue (Fig 3f).

The diagnosis of mature intraovarian teratoma was based on the identification of well differentiated tissues representing three primary embryonic germ cells (endoderm, ectoderm and mesoderm) within the same tumour. The origin

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S. A. Headley, DVM, MSc, Department of Preventive Veterinary Medicine, Universidade Estadual de Londrina, Londrina, Paraná 86051-990, Brazil
E. J. Fuck, DVM, MSc,
E. T. Fuck, DVM,
C. E. Curti, DVM,
Hospital Veterinário SOS Animal, Maringá, Paraná, Brazil

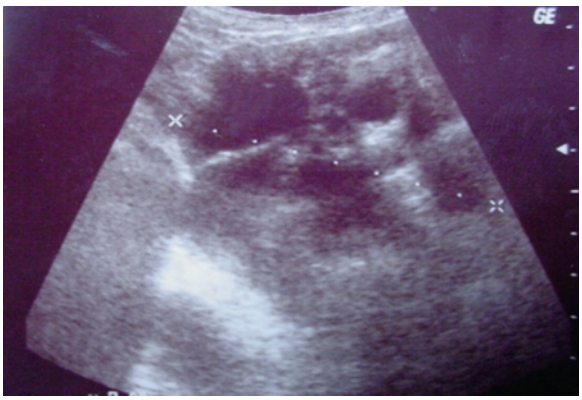

FIG 1: Heterogeneous, cystic and echogenic image of a mature ovarian teratoma in a German shepherd dog

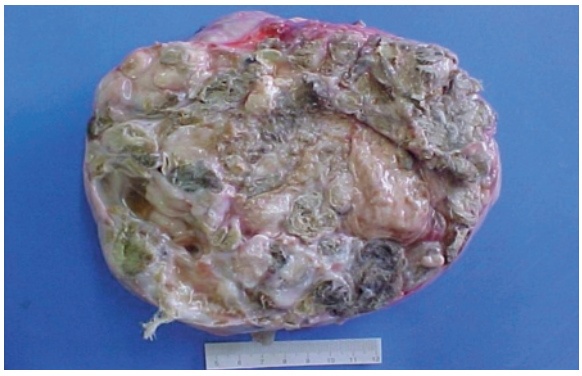

FIG 2: Sectioned surface of the mature ovarian teratoma, showing irregularly shaped cystic areas and haired skin embedded in white to cream-coloured connective tissue

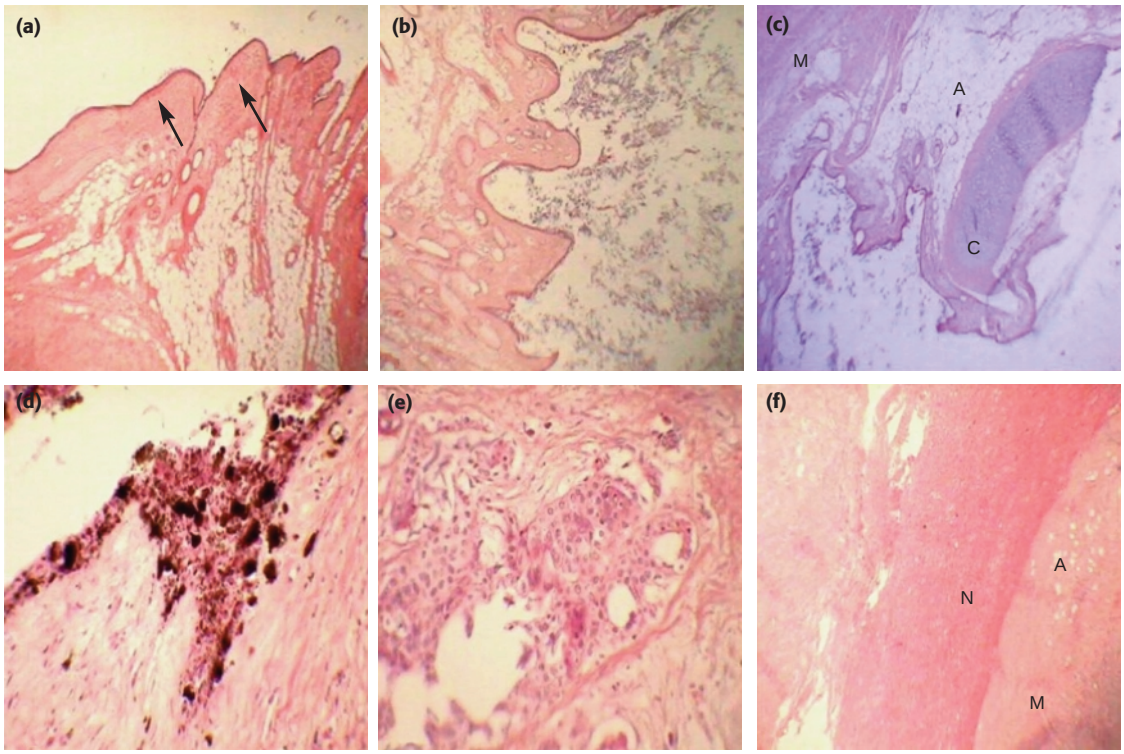

FIG 3: (a) External surface of the mature ovarian tumour, with squamous epithelium (arrows) and glandular adnexa. x 4. (b) Irregular cystic structure demarcated by squamous epithelium and filled with keratin. x 40. (c) Well differentiated hyaline cartilage (C), adipose (A) and muscular (M) tissue. x 40. (d) and (e) Plump, melanin-filled cells and glandular structures. x 40. (f) Extensive layer of nervous parenchyma (N) embedded in a matrix of adipose (A) and muscular (M) tissue. x 4. Haematoxylin and eosin

of the tumour was considered to be ovarian on the basis of its anatomical location and the marked absence of normal ovarian tissue. The pathological alterations observed in this case are consistent with previously described cases of teratoma (Nielsen and Kennedy 1990, Kennedy and Miller 1993, Basaraba and others 1998, Sforna and others 2003). Detailed descriptions of the origin of teratomas and other germ cell tumours have been published previously (Kennedy and Miller 1993, Looijenga and Oosterhuis 1999, Outwater and others 2001). Teratomas consist of pluripotent germ cells that have undergone somatic differentiation into two or more germinal cell layers, and that have probably developed from a single germ cell that has completed only its first meiotic division (Kennedy and Miller 1993, Outwater and others 2001). This explains why these tumours are predominantly intragonadal, although extragonadal forms have also been described.

Ovarian teratomas may be classified as mature, immature and monodermal (Outwater and others 2001). Mature teratomas normally demonstrate well differentiated tissues of ectodermal (skin, nervous tissue), mesodermal (muscle, fat), and endodermal (gastrointestinal and respiratory epithelium, as well as glandular structures) origin. Immature teratomas consist of poorly differentiated embryonic elements from the three cell types associated with their mature counterparts. Monodermal teratomas (for example, struma ovarii, which is constituted predominantly or only of mature thyroid tissue, with acini filled with colloid) are classified by the predominance of one embryonic cell type within the tumour (Outwater and others 2001). The histological components observed in the present case are consistent with those of a mature teratoma. Previously, teratomas were classified as solid (immature) and cystic (mature); however, this method is not favoured, since immature or 'solid' teratomas can be cystic as well as truly solid. The description of the tumour as a dermoid cystic teratoma is also considered inaccurate, since 'dermoid' could also indicate non-neoplastic congenital and acquired lesions of the skin and cornea (Nielsen and Kennedy 1990), and not simply a tumour of different germ cell origin.

Ovarian teratomas in domestic animals are predominantly benign and are more frequently observed on the left than the right side (Yamaguchi and others 2004); the tumour of the dog in the present report was benign, but occurred in the right ovary. Teratomas that demonstrate only somatic differentiation, as occurred in the present case, are predominantly benign and arise principally from the ovary, while teratomas of a testicular origin are predominantly malignant (Looijenga and Oosterhuis 1999). The capacity for malignant teratomas to form in domestic animals may thus be sex-related.

Most mature intraovarian teratomas in human beings are asymptomatic, with only a small proportion of patients complaining of abdominal pains or presenting with non-specific symptoms (Outwater and others 2001); this may explain the marked absence of signs of pain in the present case. The clinical manifestations of teratomas have been related to the sex and age of the patient affected, as well as the anatomical location and the histological composition of the tumour (Looijenga and Oosterhuis 1999). German shepherd dogs, boxers and Yorkshire terriers have been reported to have a higher prevalence of primary ovarian tumours than other breeds of dog (Sforna and others 2003); this breed susceptibility could be related to the occurrence of this tumour in a relatively young German shepherd bitch.

It is likely that the tumour developed early in the dog's life but became noticeable only during its last months of rapid growth; similar cases have been described by Sato and others (2003) and Yamaguchi and others (2004). Mature teratomas have been known to grow 1·8 cm per year in human beings (Outwater and others 2001). If this estimated growth rate is transferred to dogs, in which the second year of life is considered to compare with eight to nine years of human life, then the estimated growth rate of this tumour would be approximately 14·4 to 16·2 cm in the year. This apparent rapid growth rate of teratomas in dogs may explain why such tumours are relatively large, even when observed in young dogs.

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