The purpose of this section is to provide cases that challenge the reader to develop diagnostic plans, therapeutic regimens and case diagnoses. Both medical and surgical cases are encouraged. Figures, such as radiographs or ultrasounds, are highly recommended, but not necessary. Submissions should include an introduction, diagnosis and discussion of the case. Please contact Dr. Paul Gibbons, DVM, Section Editor, University of California, Davis, Veterinary Medical Teaching Hospital, Companion Avian and Exotic Pet Medicine and Surgery Service, One Shields Avenue, Davis, CA 95616, 530-752-1393, Fax 530-752-9620, regarding publishing requirements or radiographs, histopathology and clinical pathology results.

HISTORY

A 4.5-year-old, 3.65 kg, female green iguana, *Iguana iguana*, was presented in September for anorexia of four days duration, a distended coelom, and decreased fecal production. The iguana was housed in a latex-painted, wooden, 150x 50x150 cm enclosure with a screen top and Plexiglass front. The thermal gradient within the enclosure was approximately 28 - 31°C (82 - 88°F) during the day and 25 - 27°C (78 - 80°F) at night. Heat was provided by a 100-watt incandescent lamp, and full spectrum light was supplied by a 40-watt fluorescent lamp (Vita-Light, Duro-Test Corp., Fairfield, NJ). Both lamps were illuminated for 12 hr daily. A large water pan was provided for soaking, and the enclosure was misted with tap water once a day. The diet consisted of dark leafy greens (e.g., collard greens, mustard greens, and dandelion greens) supplemented with various vegetables and fruits. A vitamin and mineral supplement (Reptical, Tetra Terrafauna, Morris Plains, NJ) was sprinkled liberally over the food once a week.

The iguana had been examined at least once yearly during the preceding four years for health evaluations and minor illness. In January, 20 months previously, the iguana was examined for similar clinical signs, and was diagnosed with pre-ovulatory follicular development that did not result in oviposition (Figure 1). The iguana was treated without surgery, and voluntary eating resumed after three weeks.

The current physical examination findings were unremarkable except for general firmness to the abdomen upon palpation, and mild increased tackiness to the oral membranes. Digital rectal examination was not remarkable, and body condition was excellent. No skeletal abnormalities were noted. In light of the history and physical examination findings, the owner agreed to whole body radiographs, complete blood count, fecal examination, and selected plasma biochemistry assays. Before continuing, please evaluate Figures 1, 2, and 3 and Table 1 and make your initial diagnosis and treatment plan for the patient.

PLEASE EVALUATE FIGURE 1 AND TABLE 1. MAKE A LIST OF DIFFERENTIAL DIAGNOSES, DETERMINE IF ADDITIONAL DIAGNOSTIC TESTS ARE INDICATED, AND DEVELOP A TREATMENT PLAN FOR THIS PATIENT BEFORE CONTINUING.

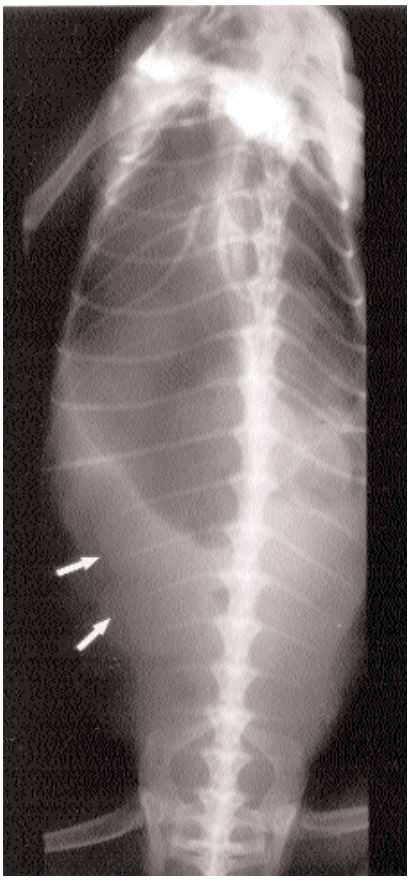

Figure 1. Dorsoventral coelomic radiograph of a 34 month old, female green iguana, *Iguana iguana*, that was presented after several days of inappetence. Note the multiple rounded soft tissue densities in the caudal half of the right coelomic cavity (arrows).

Figure 2. Dorsoventral radiographic view of the same iguana as in Figure 1. Taken at representation 20 months later, after another period of inappetance.

Figure 3. Right lateral radiographic view of the same iguana at re-presentation, as in Figure 2.

Table 1. Results of the complete blood count, fecal examination, and blood chemistry evaluation.

Measure	Units	Value	Reference range
PCV	%	51	25 - 40
WBC/ul		13,000	2,500 - 10,000
Heterophils	%	38	20 - 60
	/µl	4,940	
Lymphocytes*	%	20	10 - 60
	/µl	2,600	
Monocytes/Azurophils	%	32	5 - 20
	/µl	4,160	
Eosinophils	%	9	0 - 5
	/µl	1,170	
Basophils	%	1	0 - 3
	/µl	130	
Total Protein	g/L	48.7	
	g/dl	4.87	3.5 - 5.5
Albumin	g/L	18.1	
	g/dl	1.81	1.2 - 1.8
Glucose	mmol/L	16.0	
	mg/dl	288	40 - 140
Uric Acid	mmol/L	270	
	mg/dl	4.5	2.0 - 7.0
Calcium	mmol/L	2.885	
	mg/dl	11.54	8.0 - 15.0
Phosphorus	mmol/L	2.98	
	mg/dl	9.22	4.0 - 8.0
AST	U/L	23	10 - 80
CK	U/L	124	50 - 400
LDH	U/L	233	100 - 800
Direct fecal smear	no parasites seen		
Fecal floatation	no parasites seen		

* 5% reactive (Reference range: 1%)

DIAGNOSIS

The iguana was manually restrained as 2 ml of whole blood was collected from the ventral caudal vein using a 22 ga, 3.8 cm needle on a 3 ml syringe. The sample was submitted for complete blood count and biochemical evaluation. Dorsoventral (DV) (Figures 2 and 4) and right lateral (Figures 3 and 5) radiographs were obtained using a vertical beam and manual restraint. Radiographs show a mottled gas and soft tissue density pattern in the right dorsal coelom with a right-sided circular soft tissue density structure most evident on the DV view (Figure 4). The results of the white blood cell count, differential, and plasma biochemical analysis are listed with reference ranges in Table 1. Packed cell volume, white blood cell count (hemocytometer/eosinophil Unopette technique (Becton-Dickson, Rutherford, NJ), and differential (push slide technique stained with Diff-Quick Stain (Dade Diagnostics, Aguada, PR) were obtained. The WBC (13.0 x 10^3 cells/µl) and PCV (51%) were considered moderately elevated according to reference ranges and to a healthy evaluation of this animal 27 months previously (WBC = 6.0 x 10^3 cells/µl, PCV = 36%). Mild relative eosinophilia (9%) is not diagnostic, but could indicate parasitism (Campbell, 1996). A relative monocytosis/azurophilia (32%) with 5% reactive lymphocytes indicated an inflammatory response with chronic antigenic stimulation (Campbell, 1996). Plasma biochemical values were obtained using the Vet Test 8008 dry reagent analyzer (Idexx Laboratories, Inc., Westbrook, ME). Results included mild hyperglycemia (288 mg/dl) and mild hyperphosphatemia (9.22 mg/dl). Although uric acid (4.5 mg/dl) was not above reference ranges, it was moderately increased in relation to a measurement performed 27 m prior (1.7 mg/dl). Hyperphosphatemia without concurrent hypercalcemia indicates renal insufficiency, hypervitaminosis D, or dietary excess (Campbell, 1996). It is possible that vitamin D_3 and phosphorus were oversupplemented in this case. The initial differential diagnosis list also included chronic renal insufficiency, mild dehydration, constipation, coelomic neoplasia, coelomic granuloma, and pre-ovulatory folliculogenesis.

Initial treatment included a warm water enema that produced only three very small, soft, formed balls of feces. Aluminum hydroxide (320 mg/5 ml, Pharmaceutical Associates, Inc., Greenville, SC), 10 mg/kg PO q 24 hr and enrofloxacin (50 mg/ml, Pet Health Pharmacy, Sun City West, AZ), 7.5 mg/kg PO q 24 hr were also prescribed. The owner

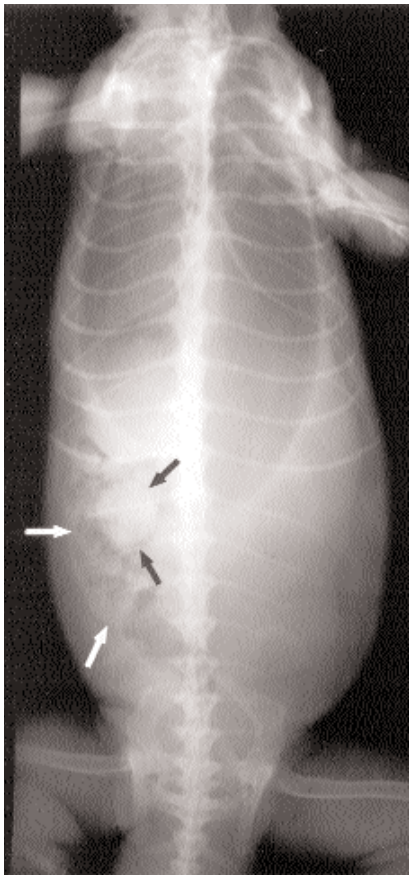

Figure 4. The same radiograph as in Figure 2. Note the mottled gas and soft tissue density pattern (white arrows) and the circular soft tissue density (black arrows) on the right side of the coelomic cavity.

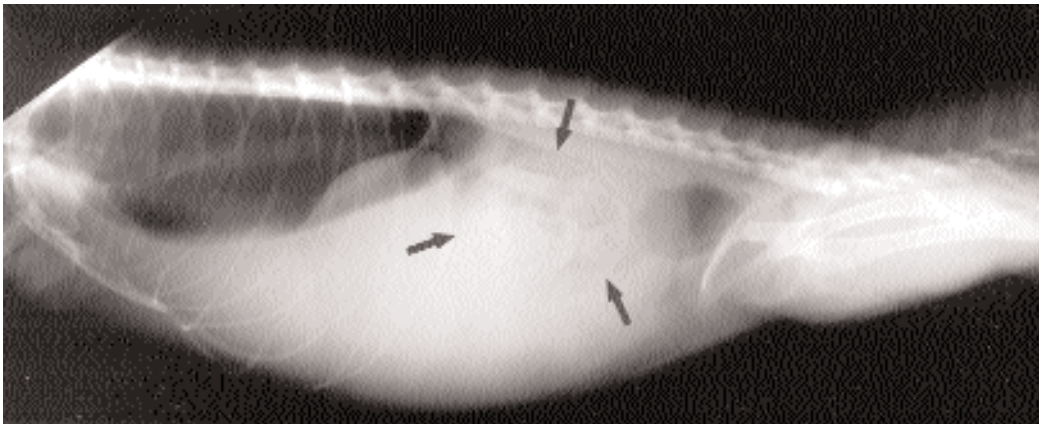

Figure 5. The same radiograph as in Figure 3. Note the mottled gas and soft tissue density pattern in the dorsal mid-coelomic region (arrows).

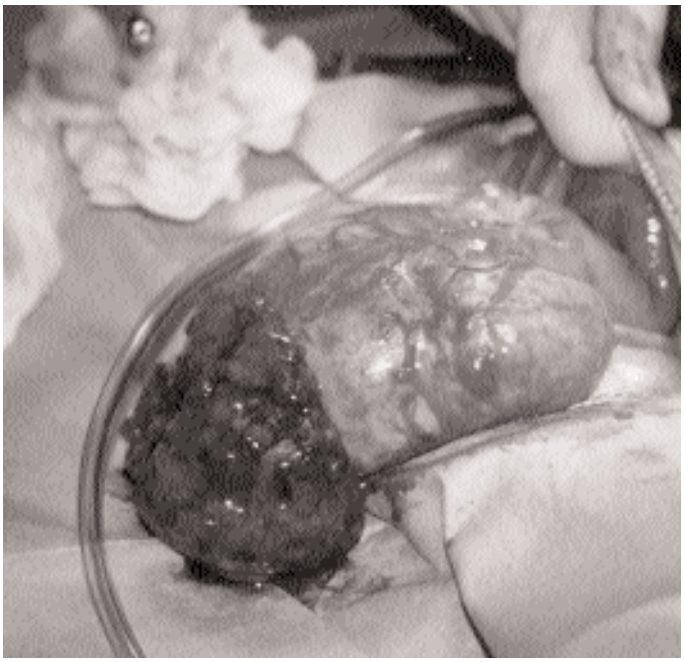

Figure 6. Intraoperative photograph of the same green iguana in Figure 2. The partially encapsulated ovarian mass is still attached to the right mesovarium.

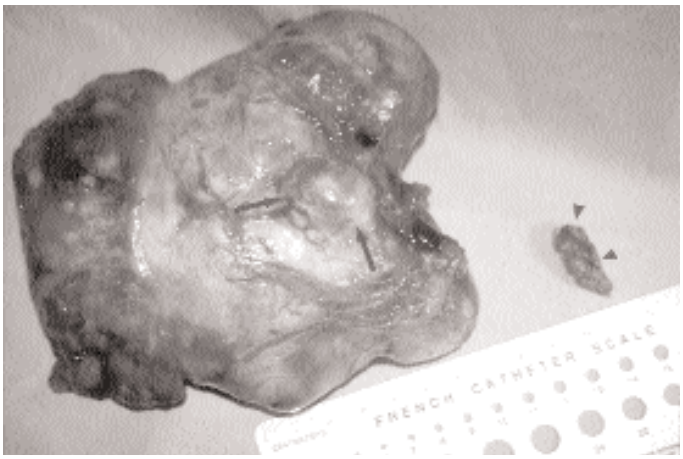

Figure 7. The same mass pictured in Figure 6. Note the round, cystic structure within the mass (black arrows) and the normal quiescent left ovary (arrowheads).

requested supplemental feeding, and was instructed to allow the iguana to lap small amounts (10 - 20 ml) of vegetable baby food from a syringe (e.g., squash or sweet potato, Gerber Products Company, Fremont, MI) daily. A tepid water (28 - 32°C:82 - 90°F) bath was also recommended for 30 min each day.

The iguana was returned 12 d later because its condition had not improved. It was generally weak with flaccid abdominal musculature. At this time, a large (approximately 10 cm diameter), firm, mid-coelomic mass was palpable. The client declined ultrasound, celioscopy, and gastrointestinal contrast studies, but agreed to hospitalization and an exploratory celiotomy for gross diagnosis without biopsies. The iguana was hospitalized at 31°C (88°F) and it immediately passed a small, hard ball of feces. Polyionic fluids (Normosol-R, Abbott Laboratories, North Chicago, IL), 10 ml/kg ICe, vitamin B complex (Phoenix Scientific, Inc., St. Joseph, MO), 0.1ml/kg SC, and aluminum hydroxide, 10 mg/kg PO, were administered upon admission to the hospital. Although the client declined further plasma biochemical analysis to evaluate the need for mineral supplementation, calcium glubionate (Calciquid, 1.8 g/5 ml, Econolab, Westland, MI), 1 ml/kg PO q 24 hr was added to the treatment plan due to generalized muscular weakness. Since Vitamin D_3 had not been supplemented for more than two weeks, the benefits of oral calcium therapy at this time outweighed the risk of soft tissue mineralization. Twelve hours later, a warm water enema produced several large blood clots without further fecal matter. Possible sources for active bleeding included the urinary, reproductive, and distal intestinal tracts. Because the blood did not appear to be mixed with feces or urates, it was most likely from the reproductive tract. Twenty-four hours later and four hours preoperatively the polyionic fluids and calcium glubionate were repeated. Enrofloxacin (Baytril 2.27%, Bayer Corporation, Shawnee Mission, KS), 7.5 mg/kg IM was administered at the time of induction with propofol (Propoflo, 10mg/ml, Abbott Laboratories, North Chicago, IL), 15 mg/kg IV into the ventral caudal vein. The iguana was intubated with non-cuffed 2.5 mm ID endotracheal tube and maintained on isoflurane (Aerrane, Fort Dodge Animal Health, Fort Dodge, IA), 3.0-3.5% in oxygen delivered at one L/min with intermittent positive pressure ventilation. The patient was placed in dorsal recumbency and the surgical site prepared with alternating chlorhexidine diacetate solution (Nolvasan solution, Fort Dodge Laboratories, Fort Dodge, IA) and 70% isopropyl alcohol (Phoenix Pharmaceuticals, Inc., St. Joseph, MO) soaked sponges, followed by 10% povidone iodine solution spray (Prodine, Phoenix Pharmaceuticals, Inc., St. Joseph, MO). A circulating warm water blanket under the patient and a radiant heat lamp directed at the surgical table were used to maintain the cloacal temperature between 30 - 32°C (86 - 90°F) during surgery. A 15 cm craniocaudal paramedian radiosurgical incision (Surgitron, Ellman International Manufacturing, Hewlett, NY) was made through the skin overlying the palpable mass, and was extended through the abdominal musculature and coelomic membrane using Metzenbaum scissors. Attached to the right mesovarium was a large (14.2x13.3x6.5 cm), partially encapsulated, irregularly shaped mass with no normal right ovarian tissue grossly evident. The encapsulated portion of the mass was smooth, rounded, and firm, while the un-encapsulated portion was dark red, rough, friable, and bled easily upon manipulation. The mass weighed 437 g (Figures 6 and 7). A round, fluid filled, cystic area within the mass was consistent with the soft tissue structure on the DV radiograph. The mass was removed by clamping and ligating the mesovarium with 3-0 proglactin 910 (Vicryl, Ethicon, Inc., Sommerville, NJ) as in a routine ovariectomy. The right renal vein and adrenal gland were easily identified and grossly normal. Although no active bleeding was found, a small amount of gas was noted inside the lumen of the right oviduct during surgical removal. The left ovary and oviduct were removed in a routine manner, and appeared grossly normal. The coelomic cavity was explored both visually and by palpation. Both kidneys appeared grossly normal, and no other abnormalities were found. Abdominal musculature was closed with 3-0 proglactin 910 in a simple continuous pattern, and skin was closed with surgical staples (Visistat 35W, Weck Closure Systems, Research Triangle Park, NC). Although the client declined further diagnostic testing to rule out differential diagnoses, submission of sections of the mass for histopathology was allowed. Anesthetic recovery was not remarkable and medical therapy was discontinued after surgery. The iguana returned to normal feeding within two weeks. One year after surgery, CBC and plasma biochemical analysis were within reference ranges, and plain-film radiographs were not remarkable.

Microscopically the submission sample consisted entirely of neoplastic tissue. The neoplasm contained small to medium sized tubular structures with a few cystically dilated, irregularly shaped tubules interspersed. The tubules were lined by cuboidal to columnar epithelial cells with very mild anisocytosis and anisokaryosis appreciated. There was a moderate amount of interspersed loosely arranged collagenous to myxomatous stroma with extension of neoplastic tubules into the stroma rarely observed. Some of the tubular structures contained luminal eosinophilic amorphous material and/or basophilic mucinous material suggestive of a secretory substance. The mitotic rate was low at less than one per every two to three high power fields. Mild mixed inflammation was present throughout the stroma, primarily lymphocytic and plasmacytic with a few interspersed heterophils. No pre-existing tissue of any kind was present in the section. The final histopathological diagnosis was ovarian adenocarcinoma.

DISCUSSION

Ideally, exploratory celiotomy would be preceded by less invasive diagnostic studies such as radiography (with and without contrast media), ultrasonography, and laparoscopy (Rubel, *et al*, 1991, Divers, 1998, Hochleithner, 1998). Computed tomography and magnetic resonance imaging are becoming more accessible in universities and metropolitan areas, and can provide valuable diagnostic information (Rubel, *et al*, 1991, Raiti, 1998). Tissue specimens can be obtained through the use of a percutaneous fine needle aspirate, celioscopic-guided needle aspirate, ultrasound guided needle aspirate, coelioscopic forceps biopsy, or keyhole biopsy. Samples should be evaluated cytologically, histopathologically, and with fungal as well as aerobic and anaerobic bacterial culture and sensitivity.

Once an intracoelomic neoplasm has been diagnosed, surgical excision is the treatment of choice if definite borders exist and wide margins can be taken. For certain tumors,

cryosurgery, radiotherapy, and photodynamic therapy have also been employed to help delay tumor regrowth in reptiles when adequate surgical margins cannot be obtained (Robinson, *et al*, 1978, Leach, 1991, Roberts, *et al*, 1991, Bryant, 1997). Chemotherapy should be considered in cases with the potential for metastasis or local recurrence, although protocols have not been established for reptiles (Jacobson, *et al*, 1981, Done, 1996, Suedmeyer and Turk, 1996).

Ovarian adenocarcinoma occurs rarely in captive green iguanas, but it has been reported (Harshbarger, 1980). No reports exist in regard to the biological behavior of such neoplasms in this species, but no evidence of metastasis or recurrence was found in this case using plain film radiography one year after surgery. This tumor had the potential to metastasize however, since it was not fully encapsulated and might have been developing for many months. In the dog, ovarian adenocarcinomas may metastasize to the regional lymphatic structures, adjacent kidney, or other abdominal viscera. In advanced stages metastasis can include the lungs, pleural cavity, or the central nervous system (Loar, 1989). A brief review of the literature did not identify etiologies of ovarian adenocarcinomas in humans or domestic animals (Barber, 1986, Loar, 1989, Wolf, 1992, Young, *et al*, 1993, Feldman and Nelson, 1996, Klein, 1996).

REFERENCES

Barber HRK. 1986. Ovarian cancer. Cancer J Clin, 36:149-184.

Bryant BR. 1997. The use of cryosurgery in a diamond python, *Morelia spilota spilota*, with fibrosarcoma and radiotherapy in a common death adder, *Acanthophis antarcticus*, with melanoma. Bull ARAV, 7(3):9-12.

Campbell TW. 1996. Clinical Pathology. *In* Mader DR (ed): Reptile Medicine and Surgery. WB Saunders Co., Philidelphia, PA:248-257.

Divers SJ. 1998. An introduction to reptile endoscopy. Proc ARAV, 41-45.

Done LB. 1996. Neoplasia. *In* Mader DR (ed): Reptile Medicine and Surgery. WB Saunders Co., Philadelphia, PA:125-140.

Feldman EC, Nelson RW. 1996. Infertility, breeding disorders, and disorders of sexual develoment. *In* Feldman EC, Nelson RW (eds): Canine and Feline Endocrinology and Reproduction. WB Saunders Co., Philadelphia, PA:640.

Harshbarger JC. 1980. Neoplasms in zoo poikilotherms emphasizing cases in the registry of tumors in lower animals. *In* Montali RJ, Migaki G (eds): Pathology of Zoo Animals. Smithsonian Ins Press. Washington DC:585-591.

Hochleithner C. 1998. Ultrasound in reptiles. Proc ARAV, 47-49.

Jacobson E, Calderwood MB, French TW, *et al*. 1981. Lymphosarcoma in an eastern kingsnake and a rhinoceros viper. JAVMA, 179:1231.

Klein MK. Tumors of the female reproductive system. *In* Klein MK (ed): Small Animal Clinical Oncology. WB Saunders Co., Philadelphia, PA:347-350.

Leach MW. 1991. Radiation therapy of a malignant chromatophoroma in a yellow rat snake (*Elaphe obseleta quadrivittata*). J Zoo Wild Med, 22(2):241-244.

Loar AS. 1989. Tumors of the genital system and mammary glands. *In* Ettinger SJ (ed): Textbook of Veterinary Internal Medicine. WB Saunders Co., Philadelphia, PA:1818-1819.

Raiti P. 1998. The use of computerized tomography and magnetic resonance imaging in chelonian medicine. Proc ARAV, 51-53.

Roberts WG, Klein MK, Loomis M, Weldy S, Berns MW. 1991. Photodynamic therapy of spontaneous cancers in felines, canines and snakes with chloro-aluminum sulfonated phthalocyanine. J Nat Cancer Inst, 83(1):18-23.

Robinson, PT, von Essen CF, Benirschke K, Meier JE, Bacon JP. 1978. Radiation therapy for treatment of an intraoral malignant lymphoma in an Indian rock python. J Amer Vet Rad Soc, 19:92-95.

Rubel A, Kuoni W, Frye FL. 1991. Radiology and imaging. *In* Frye FL (ed): Biomedical and Surgical Aspects of Captive Reptile Husbandry. Kreiger, Malabar, FL:185-208.

Suedmeyer WK, Turk JR. 1996. Lymphoblastic leukemia in an inland bearded dragon, *Pogona vitticeps*. Bull ARAV, 6(4):10-12.

Wolf AW. 1992. Infertility in the queen. *In* Kirk RW, Bonagura JD (eds): Current Veterinary Therapy XI; Small Animal Practice. WB Saunders Co., Philadelphia PA:953.

Young RC, Perez CA, Hoskins WJ. 1993. Cancer of the ovary. *In* DeVita VT, Hellman S, Rosenberg SA (eds): Cancer: Principles and Practice of Oncology. JB Lippincott, Philadelphia, PA:1226-1263.

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