A 2-year-old female green iguana (Iguana iguana) was examined with a 1-week history of anorexia, mucus in the stool, and pain on palpation of the cranial cervical area. The animal was caged in a 60-gallon aquarium with a temperature gradient of 26° to 37°C (80° to 98°F), a UV A and B light, and indoor-outdoor carpet substrate. The iguana was allowed daily exposure to unfiltered sunlight for 8 months out of the year. The animal’s diet consisted of mixed greens including collard, mustard, kale, and a temperature gradient of 26° to 37°C (80° to 98°F), a UV A and B light, and indoor-outdoor carpet substrate. The iguana was allowed daily exposure to unfiltered sunlight for 8 months out of the year. The animal’s diet consisted of mixed greens including collard, mustard, kale, and frozen mixed vegetables (corn, peas, carrots, and green beans) on a daily basis and fruit given once weekly. Phosphorous-free calcium and multivitamin powder were sprinkled every other day on the food.

On physical examination, the iguana was alert and active, with good color and skin condition. At 354 g (0.79 lb), it was considered to be at least 50% below the expected weight for a comparable healthy female, on the basis of age and husbandry conditions. There was marked soft swelling of the cranial cervical neck, just caudal to the angles of the jaw (Figure 1). On oral examination the lateral wall of the pharynx also showed marked swelling bilaterally, with the right side being more severely affected, causing obstruction of approximately 90% of the oropharynx (Figure 2).

The initial diagnostic workup consisted of a CBC, serum biochemical analysis, cytologic examination of an FNA from the right side of the neck, and radiographs of the head and neck. The CBC showed a marked leukocytosis (46,405 cells/µL; reference range, 12,000 to 25,200 cells/µL) characterized by an absolute heterophilia (27,843 cells/µL; reference range, 1,100 to 5,400 cells/µL) and lymphocytosis (18,562 cells/µL; reference range, 4,200 to 14,600 cells/µL). Other cell lines and results of the serum biochemical analysis were within reference limits. Radiographs demonstrated marked soft tissue swellings on either side of the neck. The FNA produced 4 mL of viscous, yellow fluid, in which numerous degenerated heterophils, macrophages, and bacilli were evident on cytologic analysis.

The iguana was anesthetized with propofol (8.5 mg/kg [18.7 mg/lb]) injected into the tail vein. Respiratory rate was visually observed, and heart rate was monitored with a Doppler flow detector. The swellings were explored via a ventrolateral approach to the right and left sides of the neck. Numerous cysts were encountered, which contained yellow, caseous discharge interspersed with white, soft, friable tissue. A 0.5-cm-diameter biopsy specimen of the friable tissue was excised with iris scissors for histologic examination. After completion of the procedure, both sides of the neck were flushed with 20 mL of saline (0.9% NaCl) solution, the wounds were packed with sterile gauze soaked in a 10-02-0086.indd   985
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10% povidone iodine solution, and the skin was closed with 3-0 nylon suture. A small opening was left in the incisions for gauze removal and lavage of the wounds. The gauze was removed after 24 hours. Because of the marked swelling in the oropharynx, an esophagostomy tube was placed to facilitate feeding. The biopsy specimen was submitted for histologic examination and the aspirated fluid for aerobic culture and sensitivity testing. The iguana was observed for respiratory compromise secondary to postoperative swelling but recovered from the surgical procedure without complications.

Pending results of the culture and histologic testing, the patient was discharged on enrofloxacin (5 mg/kg [2.27 mg/lb], PO, q 24 h) and cefotaxime sodium (40 mg/kg [18 mg/lb], IM, q 24 h). The owner was also instructed to flush the neck wounds twice daily with a 1% povidone iodine-saline solution and to feed 10 mL of an herbivore liquid diet twice daily via the esophagostomy tube. At a follow-up evaluation 1 week later, the external swellings had reduced in size, although the swelling in the oropharynx had not changed. The iguana was eating some of its regular diet voluntarily in addition to tube feeding. The culture and sensitivity testing produced an abundant growth of a \textit{Salmonella} spp sensitive to both enrofloxacin and cefotaxime. Wound flushing was discontinued, and antimicrobial treatment was continued for an additional 2 weeks.

Histologic examination of the biopsy specimen revealed dense sheets of proliferating round cells, which had indistinct cytoplasmic borders and small amounts of fine granular eosinophilic cytoplasm. These cells also had round to oval nuclei with a variably stippled to vesicular chromatin pattern. A few scattered cells had moderate amounts of cytoplasm. The sheets of the round cells effaced the normal tissue architecture and were supported by variable amounts of fibrous connective tissue. The mitotic index was low at 0 to 1/hpf (Figure 3). Inflammatory and hemorrhagic exudates were also present. These were characterized by abundant RBCs, deposition of fibrin with small colonies of bacteria, and numerous degenerated heterophils. The histologic diagnosis was reported as malignant lymphoma with inflammatory exudates and bacteria.

The iguana was referred to the Colorado State University Veterinary Teaching Hospital, Zoological Medicine Service for further evaluation and initiation of a treatment protocol. A CBC and serum biochemical analysis, abdominal ultrasound, and bone marrow aspirate were performed. The CBC showed a marked leukocytosis (38,500 cells/µL) with lymphocytosis (31,200 cells/µL), but the heterophilia noted on the CBC taken.
at initial examination by the referring veterinarian had resolved (5,800 cells/µL). The PCV was within reference limits at 29%, as were the monocytes (1,200 cells/µL; reference range, 300 to 2,100 cells/µL)1 and basophils (400 cells/µL; reference range, 0 to 1,000 cells/µL). The serum biochemical analysis was within reference limits. Cytologic examination of the bone marrow aspirate demonstrated erythroid hypoplasia, and 56% to 71% of the nucleated cell population was comprised of small, mature lymphocytes, interpreted as lymphoma in the bone marrow. Ultrasound examination of the coelomic cavity was essentially normal, with no masses detected.

Anesthesia was induced with an IM injection of butorphanol tartrate (0.5 mg/kg [0.23 mg/lb]),1 midazolam hydrochloride (2.5 mg/kg [1.14 mg/lb]), and ketamine hydrochloride (5 mg/kg) in preparation for placement of a VAP.1 The iguana was intubated and maintained on isoflurane in oxygen delivered to effect and intermittent positive pressure ventilation. A 1.5-cm skin incision was made over the left dorsal flank, and a 1.5 × 1.5-cm subcutaneous pouch was created with blunt dissection. A 4-cm left paramedian incision was made and extended into the coelomic cavity. The ventral abdominal vein was identified and isolated. The vein was catheterized with a 24-gauge over-the-needle catheter, and a guide wire was threaded through the catheter. The catheter was removed, and a saline-primed vascular access channel1 was inserted into the vein over the guide wire. The guide wire was removed after the vascular access channel was seated 10 cm into the vein. It was sutured to the ventral abdominal vein, and the vein caudal to the site was ligated with 4-0 synthetic absorbable suture.1 The channel was tunneled subcutaneously to the previously prepared site on the left flank and secured to the VAP button. The port was secured to the body wall by use of 3 interrupted sutures of 4-0 polypropylene. The body wall was closed with 4-0 synthetic absorbable suture1 in a simple continuous pattern, and the flank and skin incisions were sutured with 4-0 nylon in a continuous everting pattern.

During the same anesthetic event, radiation therapy was initiated with a single 10-Gy fraction of radiation directed at the affected cervical area. The iguana made an uneventful recovery from anesthesia in a cage heated to 85°F. The following day, the iguana was bright and alert, and physical examination revealed an approximately 90% reduction in size of the swelling in the ventral cervical area. A modified CHOP chemotherapy protocol was initiated (Table 1). Prednisone was administered at a dose of 2 mg/kg (0.9 mg/lb, PO, q 24 h) for 2 weeks, and the dose was then reduced to 1 mg/kg (0.45 mg/lb, PO, q 24 h) for the duration of therapy. The chemotherapy protocol was based empirically on a commonly used multagent, single sequential canine lymphoma protocol1 with drug doses reduced by one-third. Antibacterial treatment consisted of enrofloxacin administered at 5 mg/kg, PO, every 24 hours for 30 days, and meloxicam (0.1 mg/kg [0.045 mg/lb], PO, q 24 h) was given as needed for signs of pain. Meloxicam was discontinued after 7 days.

Twenty-eight days after initial examination and 10 days after initiation of chemotherapy, the iguana returned to the referring veterinarian for follow-up care. It was alert and active and had been eating its normal diet well. A 1-cm circular necrotic area had developed in the skin over the VAP. The iguana was anesthetized with propofol (9 mg/kg [4.09 mg/lb]) administered via the ventral tail vein, intubated, and was maintained with 1.5% isoflurane in oxygen and intermittent positive pressure ventilation, as previously. The area over the VAP was explored, and it was determined that a new device placement would be required to prevent infection around the port. The port was removed, the necrotic skin was debrided, and the wound was lavaged with saline solution. The end of the channel was ligated and left in place; the channel was to be reused when the port was replaced. The skin was closed with 3-0 nylon suture in an everting pattern.

One week later, the iguana was again anesthetized via propofol induction (15 mg/kg [6.82 mg/lb], IV), intubated, and maintained on 1.5% isoflurane in oxygen with intermittent positive pressure ventilation. When the port was accessed, it was found to no longer be in the ventral abdominal vein. The original entry site into the vein had sealed, and there was no evidence of notable bleeding in the surrounding area. The VAP and channel were placed by use of the technique previously described with minor modifications. The vascular access channel was placed in the ventral abdominal vein 1 cm cranial to the previous placement. The port was secured intracoelomically on the left side, anchored to the last 3 ribs with 3-0 polypropylene suture. The body wall was closed with 3-0 monofilament absorbable suture1 in a simple interrupted pattern and the skin closed with an everting horizontal mattress pattern using 3-0 nylon. Enrofloxacin treatment, which started at the time of initial placement of the VAP was continued until 1 week following this procedure, for a total of 30 days. Meloxicam was again administered at 0.1 mg/kg, turned to the referring veterinarian for follow-up care.

<table>
<thead>
<tr>
<th>Week</th>
<th>Drug</th>
<th>Dosage and route</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vincristine</td>
<td>0.008 mg/kg, IV</td>
</tr>
<tr>
<td>2</td>
<td>Prednisone</td>
<td>2 mg/kg, q 24 h, PO, for 7 days</td>
</tr>
<tr>
<td>3</td>
<td>Cyclophosphamide</td>
<td>3 mg/kg, IV</td>
</tr>
<tr>
<td>4</td>
<td>Vincristine</td>
<td>0.008 mg/kg, IV</td>
</tr>
<tr>
<td>5</td>
<td>Prednisone</td>
<td>2 mg/kg, q 24 h, PO, for 7 days</td>
</tr>
<tr>
<td>6</td>
<td>Prednisone</td>
<td>1 mg/kg, q 24 h, PO, for 7 days</td>
</tr>
<tr>
<td>7</td>
<td>Dexamethasone</td>
<td>0.26 mg/kg, IV</td>
</tr>
<tr>
<td>8</td>
<td>Vincristine</td>
<td>0.008 mg/kg, IV</td>
</tr>
<tr>
<td>9</td>
<td>Dexamethasone</td>
<td>0.26 mg/kg, IV</td>
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<td>10</td>
<td>Vincristine</td>
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<tr>
<td>11</td>
<td>Cyclophosphamide</td>
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<td>12</td>
<td>Dexamethasone</td>
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<td>13</td>
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<tr>
<td>14</td>
<td>Cyclophosphamide</td>
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<td>15</td>
<td>Dexamethasone</td>
<td>0.26 mg/kg, IV</td>
</tr>
<tr>
<td>16–26†</td>
<td>Repeat wk 11 through 17 at 8-wk intervals</td>
<td></td>
</tr>
</tbody>
</table>

*At week 23, the protocol was altered to cyclophosphamide (3 mg/kg, IV, q 2 wk) and prednisone (1 mg/kg, PO, q 24 h). Vincristine and doxorubicin were discontinued. At week 75, the protocol was again modified by discontinuing cyclophosphamide and resuming doxorubicin. The initial dose of doxorubicin was 0.26 mg/kg, IV, and the dose was incrementally increased to 0.75 mg/kg, IV, every 3 weeks. To convert mg/kg/d to mg/lb/d, divide by 2.2.
PO, every 24 hours for 7 days. This VAP functioned effectively for 6 months.

After placement of the new VAP, the chemotherapy protocol (Table 1) was continued as planned. The skin over the VAP was cleansed with povidone iodine surgical scrub and 70% isopropyl alcohol prior to use. A straight Huber point needle was used to flush the VAP with saline solution prior to administering the chemotherapeutic drugs. Vincristine was administered over 15 seconds, cyclophosphamide over 2 minutes, and doxorubicin over 10 minutes. Following the chemotherapy drug, the port was flushed with 1 mL of saline solution with 10 U/mL of heparin added. The iguana was seen weekly for follow-up evaluations either for flushing of the port or chemotherapy. A CBC was performed prior to each chemotherapy injection to evaluate the effects of the drugs. If the heterophil count was < 1,500 cells/µL, the treatment was delayed until the heterophil count exceeded 2,000 cells/µL. This situation never occurred throughout the duration of therapy. The cranial cervical swelling decreased notably following radiation therapy, but the cystic swelling in the oropharynx persisted, especially on the right side. On day 49 after the initial examination and 21 days from initiation of chemotherapy, the cyst on the right side of the throat was drained with a 22-gauge needle and syringe. Two milliliters of yellow-green fluid was removed, causing the cyst to shrink markedly. The iguana was eating well, so the esophagogastrotomy tube was removed at that time.

Over the next 3 weeks, a firm swelling developed in the right cranial cervical area. A needle aspirate produced 1 mL of viscous, amber-colored fluid, which grew a pure culture of a Salmonella spp. The iguana was anesthetized by use of propofol induction (15 mg/kg, IV), intubated, and maintained on 1.5% isoflurane and oxygen, and the area was explored. A 1.5-cm cystic mass was found, which communicated with the previously identified oropharyngeal cysts. The structure was very vascular and incorporated the right vena cava and major nerves in the neck. The nerves and vessel were sacrificed in an attempt to remove the structure entirely. Following excision, the defect was closed with 4-0 absorbable suture and the skin closed with everting mattress sutures of 3-0 nylon. Enrofloxacin at 5 mg/kg, PO, every 24 hours was initiated following surgery on the basis of sensitivity results from culture of the fluid and continued for 14 days. Meloxicam at 0.1 mg/kg, PO, every 24 hours was also provided as needed for analgesia for 7 days. The mass was submitted for histopathologic testing, and the results again confirmed a diagnosis of lymphoma with secondary infection.

Two weeks postoperatively, the wound was healing well with no swelling or abnormalities detected on examination of the right oropharynx. The owner noted a left deviation of the tongue but no apparent hindrance to the iguana’s ability to prehend and swallow food. This deviation resolved by 3 weeks after surgery. A new mass approximately 2 cm in diameter was detected deep in the left cranial cervical area. An FNA from this mass yielded 1.5 mL of yellow fluid. Following aspiration, the mass shrank to about 1 cm. On oral examination, this mass was visible on the left side of the pharynx. An additional FNA of this mass showed sheets of neoplastic lymphocytes on cytologic examination.

Six months after the second placement of the VAP, the securing sutures broke, allowing the VAP to fall free into the coelomic cavity. At this time, the iguana had grown to 630 g (1.4 lb). By use of the same anesthesia protocol used previously, the VAP was moved to a more typical subcutaneous position on the left side of the body and again secured with sutures. This placement allowed the VAP to continue to function effectively for an additional 18 months.

At 315 days after initial examination by the referring veterinarian, the iguana’s appetite began to decrease, progressing to complete anorexia. The lymphocyte count began to increase until it was consistently > 20,000 cells/µL (Figure 4). On physical examination, the patient was alert and strong. Coelomic palpation identified a lobulated mass several centimeters in diameter. An ultrasound examination identified numerous large follicles in both ovaries, indicating reproductive activity. It was decided, given the potential immunosuppressive effects of chemotherapy, that prompt ovariec-
tomy was appropriate. Anesthesia was again administered, and both ovaries were removed by means of a ventral paramedian incision. No histologic examination was performed on the ovaries. The iguana made a rapid recovery and within 2 weeks was eating voraciously.

![Figure 4—Graph showing the repeated lymphocyte counts in the iguana in Figure 1 throughout treatment including administration of CHOP chemotherapy for lymphoma. On day 161 of therapy (arrow 1), the chemotherapy protocol was modified from the original CHOP protocol to cyclophosphamide given every 2 weeks, along with daily prednisone. Vincristine and doxorubicin were discontinued. At 315 days of treatment, the iguana began to show reproductive activity and an increase in lymphocyte count. Ovariec-
tomy was performed 21 days later (arrow 2). Because of a subsequent increase in the lymphocyte count, a rescue protocol that consisted of doxorubicin administered every 3 weeks was initiated on day 525. The cyclophosphamide was discontinued but prednisone was maintained daily (arrow 3).](10-02-0086.indd 988)
again. The procedure caused an immediate loss of 143 g (0.31 lb) of body weight. This was regained by 121 days after surgery or 395 days after initial examination.

During the course of treatment, there were 2 modifications in the chemotherapy protocol. During the first 161 days of therapy, it was noted that the most dramatic effect on lymphocyte count occurred following administration of cyclophosphamide (Figure 4). Therefore, the protocol was modified to give cyclophosphamide every other week, and vincristine and doxorubicin were eliminated. The prednisone was continued as before. This kept the lymphocyte count consistently below the upper end of the reference range (14,600 cells/µL). At 483 days of therapy, the lymphocyte count began to trend upward. Six weeks later (at 525 days of therapy), it was again decided to modify the protocol. Cyclophosphamide was eliminated, and doxorubicin was initiated at 3-week intervals. The dosage was gradually increased until the lymphocyte count consistently remained below 14,600 cells/µL, which occurred at a dose of 0.75 mg/kg (0.34 kg/lb).

At the time of writing, it has been 1,008 days since initiating treatment. At the most recent posttreatment examination, the masses in the neck were no longer detectable and the patient had gained over 1,100 g (2.42 lb). The animal was active with a good appetite, and its activity and behavior were reported by the owner as normal. The iguana had been off all medication for 6 weeks. There were no detectable masses in its neck, and its WBC and lymphocyte counts were within reference ranges.

Discussion

Although reptile neoplasia is widely reported in the literature, there are very few articles reporting the use of chemotherapy4–6,9 and radiation4 for the treatment of cancer and none dealing specifically with its use treating lymphoma in green iguanas. In all reported cases,4–6,9 survival time was so short that therapy was considered ineffective. In this patient, survival time exceeded 1,008 days, and this is the first report suggesting that lymphoma in reptiles can be effectively managed in some patients.

Lymphoma is considered one of the most common cancers found in reptiles.4–9 Although several case reports4–9,11 are in the literature, very little is known about the biological behavior of this disease in reptiles. Staging of lymphomas is a commonly used method in dogs to determine prognosis and treatment regimens. Low-grade malignancies tend to be poorly responsive to therapy, whereas intermediate- to high-grade lymphomas are more responsive to chemotherapeutic agents. Dogs with low-grade lymphomas often have prolonged survival times even in the absence of treatment, although treatment tends to be less effective. The survival times of intermediate- to high-grade malignancies are much shorter but can be significantly lengthened with chemotherapy.12

For the patient in the present report, on initial examination, the cervical swelling was found to be secondarily infected with Salmonella spp, which is ubiquitous in the alimentary tract of reptiles. Outside the gastrointestinal tract, Salmonella spp are often associated with internal granulomatous disease.13 Oral manifestations of lymphoma are not uncommon in reptiles; however, biopsy specimens may contain inflammatory tissue, complicating the diagnosis of lymphoma.8,10 A similar presentation of tumor masses developing in the cervical region has been described previously in the common green iguana.8,11

There is ample lymphoid tissue in the cervical region from which lymphoma could have arisen. Reptiles lack lymph nodes, but the thymus is located in the cervical region and persists into adulthood. Additionally, there are tonsil-like lymphoid aggregates associated with the esophagus,14,15 In dogs, extranodal forms of lymphoma occur in any location outside the lymphatic system and can be confined to a single organ such as an eye, heart, testes, CNS, bladder, or nasal cavity.12 This may also be true in iguanas. The tumor in the patient in this report had morphological features consistent with lymphoma described not only in reptiles but also mammals.9,16 The sheets of neoplastic lymphocytes effaced the normal tissue architecture. In addition, the associated inflammation is a common feature reported for tumors with oral manifestations.9,16 Secondary bacterial infections are not uncommonly associated with traumatic lesions in the oropharynx.17

Captive reptiles seem to have a high incidence of internal bacterial granulomas,18,19 compared with mammals, and there are several contributing factors. The anatomy of the reptile immune system has some notable differences. Besides a lack of lymph nodes, reptiles have more extensive lymphatics,14 which may allow invading bacteria to spread more widely with less impedance from the immune system. Also, numerous stress factors inherent in captive reptiles may reduce immunocompetence. Stressors such as malnutrition, poor husbandry, and improper thermoregulation are common in reptiles kept as pets.20 Animals with neoplasia suggest a level of immunosuppression, which may predispose a tumor to become infected. Because of altered blood supply in the tumor, bacteria may be shielded from the normal immune response, particularly if areas become necrotic.

In the patient in the present report, the heterophil count was markedly elevated on the initial workup. This was attributed to a secondary bacterial infection associated with the cervical mass. A CBC performed at the referral institution 1 month later found the heterophil count had returned to within reference limits. This was interpreted as a positive response to surgical drain- age and antimicrobial treatment. After 70 days, marked swelling had returned, particularly in the right cervical area. Culture of fluid aspirated from the swelling yielded a pure growth of Salmonella spp. It is unknown if this was a continuation of the previous infection or reinfection. Because of the length of time between incidents and the previously mentioned normal heterophil count following antimicrobial treatment, we suggest that it was probably a new infection.

Our patient had a total circulating lymphocyte count of 31,200 cells/µL, representing 81% of the total WBC. However, morphologically the cells were small and mature lymphocytes, and no blastic forms were noted. The lymphocytes in the bone marrow were also

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characterized as small and mature; however, they represented 56% to 71% of the total myeloid line. These small cells are also consistent with what was found histologically on the biopsy of the oropharyngeal mass. These proliferations of small lymphocytes are consistent with some previous reports6 of lymphoma in lizards.

At day 315 of treatment, the iguana in the present report began to show lymphocytosis and was found to be reproductively active. It is unlikely that the lymphocytosis in this patient was caused by the folliculogenesis and subsequent preovulatory follicular stasis, as this had not been reported to occur. However, the physiologic stress associated with follicular development and then subsequent preovulatory stasis may have weakened the patient, allowing for the malignancy to proliferate so that the lymphocytosis was seen associated with the follicular development. Another possibility for the lymphocytosis is the follicles may have become infected, which can happen in follicular stasis. Alternatively, when examining the lymphocyte counts over time, there appeared to be spikes periodically and approximately every 150 days, and the spike in the lymphocyte count over this time frame may have been completely unrelated to the follicular development and subsequent stasis.

There is insufficient information about lymphoma in reptiles to be able to meaningfully stage this disease. However, our best adaptation of the World Health Organization criteria for lymphoma staging would place this iguana as a stage Vb, because of the detection of disease in the blood and bone marrow and the presence of clinical signs of illness at the time of diagnosis. In previous cases in the literature, diagnosis was made either at necropsy or prior to a short course of disease, generally < 3 months.9,11,21,22 In dogs, distinguishing between B-cell and T-cell origin lymphomas can aid in establishing a prognosis and treatment plan. Most high-grade tumors are of B-cell origin, whereas low-grade malignancies are more commonly of T-cell origin.12 In some of the reptile reports, immunohistochemistry to determine cellular origin of the lymphomas was attempted, but no correlation to the biological behavior of the tumor was made.9 The accuracy of the markers used is poorly documented.23 No determination of immunophenotype was made in this patient.

In dogs, systemic chemotherapy is the treatment of choice for lymphoma, with multidrug protocols superior in efficacy to single-agent protocols. Radiation and surgery are used as an adjunct to chemotherapy in some patients to treat local disease that is impairing function, as was the case in this iguana. The most common multidrug lymphoma protocols used in dogs are based on combinations of the drugs doxorubicin, cyclophosphamide, vincristine, and prednisolone.3,12

There are only a few reports4–6,h of cancer treatment involving the use of radiation or chemotherapy in reptiles. The administration of doxorubicin, carboplatin, and cytosine arabinoside has been reported, but there are no pharmacokinetic studies for any cancer drugs in reptiles. There is no information on the long-term use of these drugs, and dosages have been extrapolated empirically from other animals. A CHOP protocol was modified empirically for use in this patient. It was based on the assumption that metabolism of these drugs in the iguana would be prolonged because of reduced metabolic rate in reptiles. The dosages were scaled down to one-third the dose administered to dogs. As is similar to the neutrophil count in dogs, the heterophil count threshold of 1,500 cells/µL was used as an indicator of toxicity. In this patient, the heterophil count never decreased below 2,000 cells/µL; hence, the dosage was never decreased nor administration frequency changed. Monitoring the overall WBC count and lymphocyte count was 1 method used to gauge response to the drugs, together with reduction in tumor size, weight gain, and quality-of-life assessment.

Lymphomas in mammals are known to be extremely sensitive to radiation therapy, and a single fraction of radiation is often sufficient to adequately palliate local clinical signs while chemotherapy is given time to work. This seemed to be the case in this iguana, as evidenced by the rapid reduction in mass size following radiation treatment. A dose of 10 Gy was chosen because this dose, when administered as a single fraction, is known to be associated with a very low risk of either acute or late adverse effects in other species.24

Other than regularly adjusting the dosages to account for weight gain, the original protocol was altered twice in this iguana. It was noted that the most marked change in the lymphocyte count occurred following the administration of cyclophosphamide. It was decided to eliminate doxorubicin and vincristine from the protocol and administer only cyclophosphamide and prednisone. Over time, the effectiveness of cyclophosphamide seemed to diminish as evidenced by a rising lymphocyte count; hence, it was decided to use single-agent doxorubicin as a rescue protocol. It was administered every 3 weeks, initially at 33% of the standard 1 mg/kg dose used in cats and dogs under 15 kg (33 lb) in weight.12 Gradually, the dosage was increased until results on the basis of change in the lymphocyte count were noted without marked heteropenia, at 75% of the 1 mg/kg dog dose. There were no signs of toxicosis (eg, appetite loss, change in stool consistency, or evidence of cardiac or renal impairment) observed at any time.

The concurrent use of prednisone and an NSAID (meloxicam) has been associated with increased risk of gastrointestinal toxicity in mammals. It is unknown if this is also a concern in iguanas. There is little information available dealing with the effectiveness and safety of analgesic drugs in reptiles. Meloxicam has, anecdotally, been reported to be effective in reptiles.25 It was decided the risks were relatively low when this drug was used with prednisone for short-term analgesia following surgery. There were no apparent adverse effects noted in this patient.

Very little is known about the effects of the drugs used in this protocol on reptiles in general and, more specifically, on green iguanas. There is evidence that corticosterone, the active innate glucocorticoid in reptiles, suppresses immune activity in marine iguanas.26 Therefore, it is likely that exogenously administered corticosteroids such as prednisone will have a detrimental effect on immune function in other reptiles, but further research is needed to elucidate these effects. In the patient in the present report, it was our assump-
tion that these drugs would be similarly immunosuppressive in reptiles as in other more familiar species. The toxic effect of granulocyte count depression was monitored for but never realized in this patient. It is unknown whether reptiles experience this toxic effect on granulocytes or if the dosages used were not high enough to manifest it. As noted, there are no pharmacokinetic studies of these drugs in reptiles. It may be that higher doses could be used to improve response in future cases.

A VAP was placed at the initiation of therapy in this patient. Necrosis of the skin over the port was an immediate complication with its use. The cause of this is uncertain. One possible cause may have been extravasation of vincristine from the port following the first injection. Because of the small size of the patient, pressure necrosis of the skin over the port may have been another possible cause. Modification in the placement of the VAP from a subcutaneous site into the coelomic cavity was made to eliminate the second possibility, and this was effective. Although this placement eventually ceased to function 6 months later, it did function long enough to allow the iguana to grow amply so that a normal subcutaneous placement could be utilized without complication. Use of the new subcutaneous VAP placed in this patient was effective and well tolerated for an extended period of time, functioning for an additional 18 months.

References