Male snakes and lizards possess paired copulatory organs called hemipenes that are located in the tail immediately caudal to the vent. The hemipenes are inverted and attached to the ventral processes of the coccygeal vertebrae by retractor muscles. Sexing in male snakes is performed by inserting appropriately sized probes into the hemipenal pockets. Male snakes usually probe 12-16 subcaudal scales. Female snakes, lacking hemipenal pockets, probe 2-6 subcaudal scales. Boas and pythons are sexually dimorphic; males possess cloacal spurs which are utilized during copulation. Females either lack these structures or they are reduced in size. In those species of lizards in which sexual dimorphism is not apparent, such as bearded dragons (Pogona vitticeps) and monkey-tailed skinks (Corucia zebrata), sexing can be performed under sedation. Ketamine hydrochloride (Ketaset, Bristol-Meyers, Fort Dodge, Iowa) is administered at 20 mg/kg i.m. followed by masking with isoflurane (Aerane, Anaquest, Madison, Wisconsin) at 2-3%. Digital pressure is applied to the base of the hemipenal pocket causing temporary prolapse of the organ. Male chelonians and crocodilians possess single copulatory organs which are located on the floor of the cloaca.

In snakes and lizards the hemipenes can become clogged with inspissated semen and desquamated epithelial cells. This condition occurs during breeding season. It is associated with premature ejaculation or repeated copulatory attempts with a female that is not receptive. The vent appears swollen and painful. Upon retraction of the first caudal scale the hardened tip of the hemipenal plug becomes visible. It is grasped with blunt forceps or hemostats and pulled cranially while pushing on the base of the hemipenal bulge. An antibiotic cream such as silver sulfadiazine (Silvadene Cream 1%, Marion Labs, Kansas City, Missouri) is then applied to the vent.

Prolapsed male copulatory organs (paraphimosis) are also seen more frequently during breeding seasons. Chelonians and snakes are most commonly affected. This condition is associated with trauma during copulation (if the male is dragged by the female). In chelonians it can also occur due to bite wounds. Substrate adhering to the prolapsed organ coupled with desiccation prevents retraction of the affected organ. Initial therapy should be directed toward reducing cellulitis and controlling secondary infection. This is accomplished by immersion in a hypertonic solution and administering topical antibiotics such as 1% silver sulfadiazine. In chelonians it is easy to reposition the prolapsed penis due to the markedly distensible cloaca. After the organ has been repositioned under anesthesia (ketamine and isoflurane), one or more purse string sutures are placed around the vent. Sutures are removed in approximately 4 wk. In snakes and lizards it is more difficult to replace the prolapsed hemipene into the hemipenal pocket. Sometimes blood may be aspirated from
the engorged venous sinus causing a reduction in size of the organ. After the hemipene is replaced into its respective pocket a purse string suture is placed in the cloaca to prevent subsequent prolapse. If the hemipene is necrotic than amputation is performed. Polydioxanone mattress sutures (PDS, Ethicon, Somerville, New Jersey) are placed in the base of the organ to prevent hemorrhage. Amputation is performed approximately 3 mm distal to the sutures.

Dystocia has been reported to occur in approximately 9% of captive reptiles. It develops secondarily to a variety of circumstances such as unsuitable substrate availability, morphologic abnormalities (excessively large eggs, dead fetuses, uterine obstruction/compression), and uterine infections. Clinical signs are variable. Egg bound reptiles may appear restless in an effort to locate suitable nesting sites. Sometimes there is a cloacal discharge. In chelonians paresis may be observed due to pressure on the obturator nerves from an egg(s) lodged in the pelvic canal. Eventually the egg bound reptile becomes depressed and dehydrated. Diagnosis in long term captives is greatly aided when presented with an accurate history. Knowledge of observed breeding dates and normal gestation period for that particular genus aids in determining anticipated ovipositing dates. For example, gestation for most temperate colubrids is from the last copulation until 10-14 days after the next shed (pre-egglaying shed). During gestation the gravid snake normally refuses food and should have access to a warm spot of 30°C (85°F). In wild caught specimens one must rely on natural reproductive data (if available), physical examination, and specific diagnostic tools. This can be complicated by the fact that many female reptiles can store sperm in oviductal seminal receptacles for years prior to fertilization. The decision for veterinary intervention should be based upon several factors. If gestation time is significantly longer than normal for the taxon involved and the reptile is debilitated then prompt therapy is indicated. Hematology and plasma biochemistries can eliminate common complications such as hypocalcemia and renal disease. Radiography, in addition to confirming gravidity or pregnancy, can also identify abnormalities such as metabolic bone disease and fused, fractured, or excessively large eggs. In the green iguana (Iguana iguana), which is commonly presented for anorexia associated with reproductive problems, dystocia has been divided into two phases, pre-ovulatory follicular retention and postovulatory egg retention.

In the former condition the follicles have radiographically indistinct borders and tend to be located more cranially in the coelomic cavity. Plasma calcium and phosphorus values are markedly elevated during this time. Resorption of these follicles normally occurs over a period of approximately 3 wk. Postovulatory eggs are characterized radiographically by more distinct borders and occupy the entire coelomic cavity. In chelonians, fractured eggs may be caused by sexually aggressive males. Excessive circumferential calcareous lamellae indicate prolonged egg retention. Correcting dehydration and maintaining the reptile within its preferred optimal temperature zone (POTZ) are of paramount importance before the administration of therapeutics. Dehydrated reptiles soaked in balanced electrolyte solutions commonly gain up to 25% of their body weight.

Unless surgical intervention is clearly indicated, medical therapy or changes in husbandry should be attempted to stimulate oviposition. For example, it is known that gestation in the iguana is approximately 50-60 days. If a healthy iguana diagnosed with postovulatory egg retention has not been provided with a suitable nesting site then recommended husbandry modifications may be
appropriate. Substrate composed of sand and potting soil at a 1:1 ratio, placed in a horizontal plastic container 4 ft long, provides a suitable ovipositing chamber. Vasotocin is the naturally occurring reproductive neuropeptide found in reptiles; hence, oxytocin is not as effective in inducing uterine contractions. At this time, however, oxytocin is the only available hormone in its class that is available to veterinarians. Chelonians respond better than snakes and lizards to oxytocin; in fact, oviposition usually occurs within 1 hr after administration of oxytocin (Oxytocin, Phoenix Pharmaceutical, St. Joseph, Missouri) at 10 U/kg i.m. b.i.d. for 48 hr. Oxytocin seems to work more effectively when administered at a higher dose (2 U/100 g i.m. b.i.d. for 2-3 days) in snakes and lizards. Concurrent treatment with calcium (Calphosan, Glenwood Inc., Tenafly, New Jersey) at 0.5 ml/kg i.m. is controversial. In the author's experience calcium does not appear to enhance uterine contractions in reptiles unless hypocalcemia is present. Treated patients should be placed in a warm secluded environment at 30-36°C (85-90°F). In snakes, if there is no response by 48 hr, ovacentesis of the most distal egg is performed. Sedation is usually not required. A 22 ga needle attached to a 10 ml syringe is used. After swabbing the skin with alcohol and betadine solution the needle is inserted at the junction of the lateral and ventral scales. The average colubrid egg contains 10 ml of content. By decompressing the egg, and repeating oxytocin, the chances of induced oviposition are dramatically increased. Subsequently, the collapsed egg commonly passes within 24 hr. If the decompressed egg does not pass, then sedation with ketamine and isoflurane anesthesia is performed. Utilizing a vaginal speculum the cloaca is dilated and the collapsed egg is grasped with towel forceps. If there are oviductal adhesions further manipulation should immediately cease and salpingotomy performed.

The technique for celiotomy/salpingotomy has been well described. After induction with ketamine and atropine (atropine sulfate, Phoenix Pharmaceutical, St. Joseph, Missouri) at 0.02 mg/kg i.m.) intubation is performed. In reptiles the glottis is open only during active respiration. Isoflurane is the anesthetic of choice and maintenance is achieved at 2-3% with oxygen flow at 1 L/min. Reptiles lack a counterpart of the mammalian diaphragm and so positive pressure ventilation at 5 breaths/min is employed during anesthesia. Heating pads set at 28°C (82°F) are also recommended. The surgical site is aseptically prepared with alcohol and betadine solution. In snakes, an incision for celiotomy is made at the junction of the ventral and first row of lateral scutes. This surgical approach avoids the large abdominal vein and prevents the incision from coming in direct contact with the substrate postsurgically. Beneath the skin lies the abdominal muscle layer and peritoneum which are incised. Sometimes multiple incisions have to be made in snakes that have more than one retained egg. After the egg(s) has been removed the oviduct is closed with an inverting pattern if possible. Many times the oviduct is attenuated permitting only simple interrupted sutures. Reptiles do not possess lysozymes; accordingly, suture material that is degraded by hydrolysis rather than phagocytosis (polydioxanone) should be used. Skin closure is done in an everting pattern. In lizards a paramedian incision is recommended. This avoids the abdominal vein; once visualized it is retracted laterally. Ovariectomy is recommended for pre-ovulatory follicle retention in iguanas (assuming there is no anticipated breeding plans). Frequently, these follicles never undergo resorption causing high mortality rates due to accompanying anorexia. Ovariectomy is easier to perform during folliculogenesis when the follicles are enlarged because the stretched mesovarium permits exteriorization of the ovaries and better visualization of the vasculature. The right and left
ovaries lie adjacent to the vena cava and adrenal gland respectively. The oviducts do not have to be removed during the procedure. With postovulatory egg retention an ovariohysterectomy is recommended. If the ovaries are left in the coelomic cavity future ovulations may deposit ova in the coelomic cavity leading to egg yolk peritonitis. Due to the thin abdominal musculature an everting single layer closure is performed using nylon. Prophylactic antibiotics are administered for 1 wk postoperatively due to the difficulty of sterilizing the skin.

Uterine (distal oviductal) prolapse occurs more commonly in chelonians than other reptiles. It may be associated with dystocia or any condition that causes tenesmus such as parasitism or obstipation. If the affected tissue cannot be replaced through the cloaca then celiotomy is performed. This procedure presents a unique challenge in chelonians due to the plastron. In some species that have a reduced plastron such as the common snapping turtle (*Chelydra serpentina*), access to the abdomen is accomplished through either inguinal pocket. In most cases however a "trap door" with a hinge on one side is created using an orthopedic drill or Dremel motor kit. One side is left attached to the plastron to preserve the vascular supply to the flap. The exact location of the osteotomy is based upon radiographic findings; however, most incisions are made in the abdominal and femoral scutes. The pelvic bones and muscles should be avoided. Immediately beneath the abdominal musculature and peritoneum are two large venous sinuses that can be retracted. Salpingotomy and/or ovariohysterectomy is then performed as described above. When concurrent infection is suspected microbiological cultures should be done. Closure of the plastral flap is done using sterilized fiberglass and epoxy. Care must be taken to avoid getting epoxy in the circumferential defect as this may lead to delayed healing. Flunixin meglumine (Banamine solution, Schering-Plough, Union, New Jersey) administered at 1.5 mg/kg i.m. s.i.d. for 2 days appears to diminish postsurgical discomfort and initiate an earlier return of appetite.

Infectious salpingitis is associated with ascending infections from the cloaca. *Pseudomonas* spp. was isolated from bilaterally infected oviducts in a pregnant Solomon Island ground boa (*Candoia carinata paulsoni*) which delivered stillborn young. Parasitic salpingitis (*Monocercomonas* spp.) causing fetal deaths has been reported in a boa constrictor.

Oophoritis may be aseptic or infectious. Aseptic inflammation of the ovaries has been reported in geriatric turtles while follicular resorption was occurring. Trauma can cause follicular rupture producing severe egg yolk coelomitis. Bacterial infections and ovarian cysts have also been reported. Pseudomonads, coliforms, and salmonellae are some examples of bacterial isolates from infected ovaries. Diseased ovaries can become enlarged enough to cause visible distension of the abdomen. Treatment requires celiotomy, ovariectomy, abdominal lavage with dilute betadine solution, and treatment with appropriate bacteriocidal antibiotics based upon culture and sensitivity results.

Aggression in sexually mature iguanas has been well documented. This occurs during breeding season, however some specimens are aggressive throughout the year. Castration is currently being performed on a limited basis; long term results have yet to be documented. The testicles are located in the same location as the ovaries and the technique is similar to ovariectomy. Better results have
been preliminarily reported when castration is performed prior to sexual maturity when the iguana has a snout to vent length of approximately 12 in. Territoriality is diminished in conjunction with development of the secondary sexual characteristics. Some veterinarians are now routinely recommending spaying and castration in all iguanas that not intended for breeding purposes.

REFERENCES


