Cassowary Pediatrics

April Romagnano, PhD, DVM, DABVP (Avian Practice)[a,b,*],
Richard Glenn Hood[c], Scott Snedeker, MD, DABIM[c],
Scott G. Martin, DVM, MS[b]

KEYWORDS

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• Pediatrics • Breeding

The cassowary is a keystone species on which the continued diversity of rainforest plants in Queensland, Australia, and nearby islands is vitally dependent. By latest estimates, fewer than 1500 birds remain in the Northern Region of Australia. Threats to cassowary survival around human habitation and in the wild include vehicles, dogs, feral pigs, habitat fragmentation and degradation, hunting, and natural disasters. Internal parasites (particularly ascarids), aspergillosis (*Aspergillus fumigatus*), and avian tuberculosis (*Mycobacterium avium*) are some of the infective agents that cull many immature birds (up to 12 months of age) in areas of compromised habitat. This has been seen in captivity as well.[1]

Our goal is to establish a more stable population of cassowaries, double and single wattle, than what we currently have in the United States. That population is tenuous at best but getting better. Our hope is to encourage others who have cassowaries in the United States to breed them successfully by raising these birds in an environment that more closely resembles their habitat for the general well-being of each individual bird. Perhaps in the future these captive bred birds may even be of value as a backup reservoir to Australia's population by providing new genetic diversity.

THERE ARE THREE SURVIVING SPECIES OF CASSOWARIES

The *Casuarius casuarius,* also known as the southern cassowary or double-wattled cassowary, is found in southern New Guinea, northeastern Australia, and the Aru Islands[2–5] (**Fig. 1**).

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[a] Avian & Exotic Clinic of Palm City, Inc, 4181 SW High Meadow Avenue, Palm City, FL 34990, USA
[b] Animal Health Clinic, Inc, 5500 Military Trail, Suite #40, Jupiter, FL 33458, USA
[c] The Cassowary Conservation Project, 3301 South Brocksmith Road, Fort Pierce, FL 34945, USA
* Corresponding author. Avian & Exotic Clinic of Palm City, Inc, 4181 SW High Meadow Avenue, Palm City, FL 34990.
E-mail address: drapril@scripps.edu

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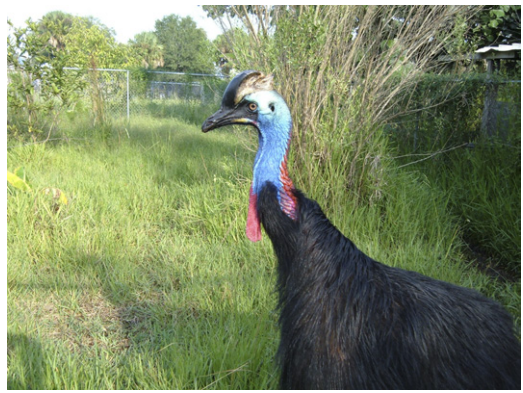

Fig. 1. Adult double-wattled cassowary.

The *Casuarius unappendiculatus,* also known as the northern cassowary or single-wattled cassowary, is found in northern and western New Guinea and in Yapen[2–5] (**Fig. 2**).

The *Casuarius bennetti*, also known as the dwarf cassowary or Bennett's cassowary (no wattle), is found in New Guinea, New Britain, and Yapen, mainly in highland[2–5] (**Fig. 3**).

NATURAL HABITAT

Cassowaries are native to the northern tropical rainforests of Australia, New Britain, Yapen, and Papua New Guinea. Single-wattled cassowaries are primarily from New Guinea and nearby smaller islands, while double-wattled cassowaries reside in the humid rainforests of northeastern Australia and New Guinea. Dwarf cassowaries are mainly found in the highlands in New Guinea, New Britain, and Yapen. Cassowary migration between New Guinea, New Britain, Yapen, northern Australia, and nearby smaller islands has been enhanced by centuries of trading by the indigenous human population[2–5] (**Figs. 4–6**).

Fig. 2. Adult single-wattled cassowary.

Fig. 3. Adult dwarf cassowary.

All 3 surviving subspecies of cassowaries are omnivorous but are predominantly frugivors. The natural diet of the cassowary comprises fruits, flowers, snails, and insects, as well as frogs, fish, mice, rats, carrion, and small birds.[2–5]

Cassowary chicks have been observed in the wild to eat the waste of adult male cassowaries.[5,6] Coprophagia may be a form of feeding from parent to young, hence an alternative strategy to regurgitation. This behavior has been observed in wild cockatoos, where neonates are fed their parents' feces. Ostrich chicks are also routinely observed consuming adult droppings. Coprophagia of adult male feces is not essential to cassowary chick viability, as captive chicks are typically raised from incubated eggs and have no access to either parent. Coprophagia, however, is practiced by captive raised cassowary chicks as well, which eat their own and their clutch mates' feces.

NONBREEDING/RESTING PERIOD

In the northern hemisphere, captive cassowaries rest from the beginning of August through mid-November. During this period, breeding adult birds are calmer and less

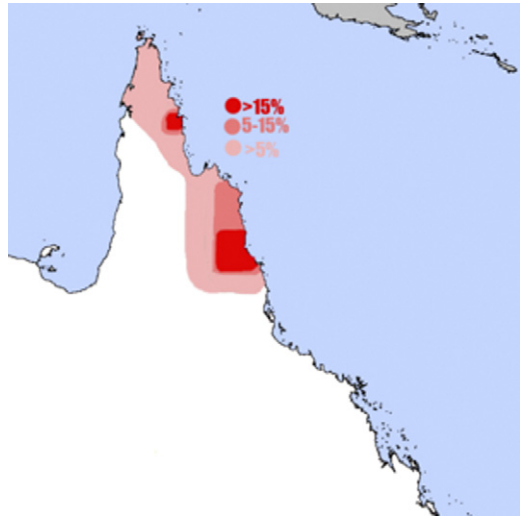

Fig. 4. Natural habitat.

Fig. 5. Natural habitat rainforest.

interactive. Adult birds eat up to 5 gallons of peeled fruit and 4 cups of a protein source, such as dry pelleted dog food or monkey chow, each day.

Females and males of a breeding pair are best fed separately, as females may become aggressive while feeding. Females eat first and continue until they are sated. If fed together, males stand behind and to the side of the female while she eats. If a male gets between the female and food, she will hiss and kick him back into a submissive posture quite promptly and with apparent indignation. During this time, the males may occasionally take a few pieces of fruit.

As gravid female birds gorge, storing fat for egg development and production, the smaller males are typically deprived by their dominant hungry hens. Female cassowaries should be housed separately from their male mates during any periods of conflict. These periods vary and are dependent on the individuals. Careful observation of breeding pair behavior in this regard is key.

Cassowaries swim and relish frolicking in the water. They also mate in the water as well as on land.

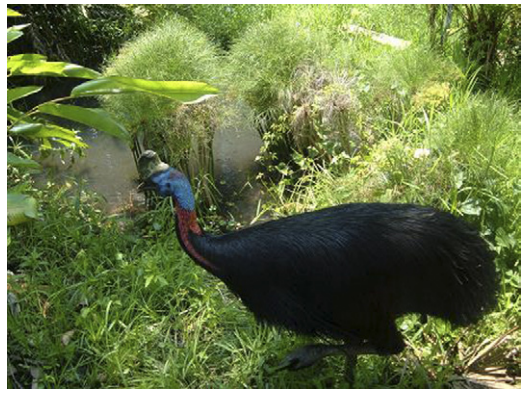

Fig. 6. Created habitat.

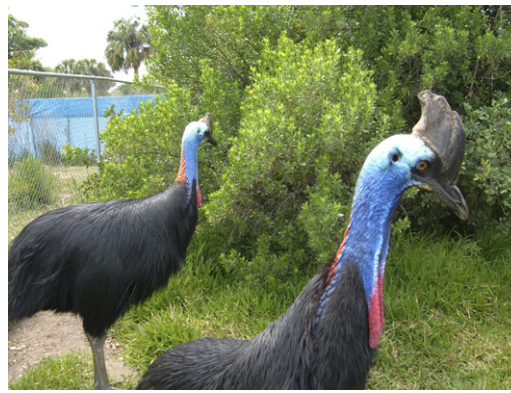

Fig. 7. Breeding pair.

PARENTAL HISTORY

It is important to keep records of the parents' diet, habitat, health, and breeding history. Note the condition of the parents' siblings if possible. Research for possible consanguinity between the breeding pair, as there are only a few bloodlines of cassowaries in the United States (R. Rundel, Denver Zoo and Natural Bridge Zoo, personal communication, December 2009). It would be ideal to obtain the history of offspring from previous seasons' clutches of the pair and any problems these chicks may have had during incubation, hatching, and maturation to help maximize future breeding success.

SEXUAL DIFFERENTIATION AND BREEDING

Cassowaries are predominantly sexually monomorphic. However, a few general characteristics help to determine a bird's sex. Generally, females are larger than males overall, especially in leg and foot proportion. At the beginning of the breeding season, female cassowaries are normally more aggressive than males (**Fig. 7**).

Since the first requirement for successful captive breeding is heterosexual or true pairs, gender determination is important for successful cassowary aviculture. The best options for sexing are blood DNA sexing for chicks and feather DNA sexing for adults.

Surgical sexing, the most accurate method of gender determination in monomorphic birds, is not recommended for cassowaries. Surgical sexing requires capture and anesthesia—a procedure that is not usually practical for adult cassowaries.

CLUTCHING: WILD VERSUS CAPTIVE

In the wild, the female cassowaries are polyandrous. They may have up to 4 different male mates serially in a single breeding season. The female lays approximately 16 eggs per breeding season. Each male cassowary, however, only breeds with a single female per breeding season.

After breeding, a female cassowary typically will lay up to 4 eggs per clutch in the nest prepared by the male. The male then drives off the female. The male subsequently dedicates the rest of the season to protecting, brooding, and hatching the eggs while the female seeks another mate. The male protects, feeds, and raises the young from the day they hatch to 14 to 16 months of age. Cassowary chicks are

Fig. 8. Laid egg.

precocial and follow the father's lead—learning to forage for berries, fruit, small insects, amphibians, reptiles, rodents, carrion, and fish.

In captivity, a healthy female cassowary can lay up to 20 eggs if each egg is removed on the day it was laid. This equates to a 5-clutch breeding season in the wild. If each egg is removed promptly from a breeding pair, the female continues to mate with the male and he will continue to court her. Without eggs in his nest, the male will not begin brooding. Once the male begins brooding, either in captivity or the wild, he will become more aggressive and drive off the female. If the female is confined in captivity with the male when he is brooding, he may kill her.[2] However, the situation reverses if the female is finished with her ovulation and the male is still present in the same confined habitat. In this case she may attack and kill him.[2] Some pairs, however, can remain together peacefully in captivity year round. Caution and careful observation are prudent.

INCUBATION

In captivity, cassowary eggs should be collected on day 1. This improves clutch size for the season, and prevents predators, environmental conditions, or parental conflict from damaging the eggs.

Successful artificial incubation is dependent on several parameters once the eggs are taken from the parents. These include egg rotation, temperature, humidity, vibration, and airflow in the incubator. Once incubation starts, it must be continued within strict parameters and consistent environmental conditions[7,8] (**Fig. 8**).

EGG ROTATION

A Georgia Quail Farm Sportsman Model 1536 (GQF Manufacturing, Savannah, GA, USA) is a ratite incubator for ostriches and emus that has been found to be consistently effective for incubating cassowaries and is used by the authors. This incubator automatically turns the eggs alternately 180° every 3 hours on the egg's long axis. Good-quality incubators use timed mechanical turners with an average turn frequency of 10 hemirevolutions per day (**Fig. 9**).

INCUBATOR TEMPERATURE

Carefully maintaining temperature settings between 97.0°F and 97.5°F yields excellent chick viability. Historically, incubation temperature and humidity have varied for

Fig. 9. Eggs in incubator.

different avian species, with settings ranging from 98.9°F to 99.3°F (37.3°C) with 30% to 45% humidity. It should be noted that viability of cassowary embryos using these parameters has been very poor (~3%). Considerably higher humidity settings (see later) and lower temperature settings have resulted in a much higher average embryo viability and chick hatching rate of 45%.

HUMIDITY

High cassowary chick viability is attributed to humidity settings being carefully monitored and kept between 57% and 64%. Any greater humidity fosters the development of "wet chicks." These chicks often drown at pipping due to excessive liquid albumin. Moreover, they are often edematous and as a result weak and slow to stand after hatching. Conversely, eggs exposed to low humidity may dry out, causing adherence of the shell membrane to the chick, preventing normal pipping. Incubator humidity is maintained by a reservoir within the incubator with capillary wicks supplied by a gravity siphon and a circulating fan. Wicks must be reversed daily to maintain a constant rate of evaporation. The ideal conditions in the incubation room should be maintained between 73°F to 75°F (22.5°C) and 43% to 48% humidity.

WEIGHT AND STRUCTURAL CHANGES DURING DEVELOPMENT

A healthy developing cassowary egg normally loses a small fraction of its water weight by diffusion during incubation (day 1 to external pip). Further data with regard to changes in egg weight during incubation are being collected. The air cell enlarges normally at the larger end of the egg between the inner and outer shell membrane as the egg loses weight during incubation. If the humidity is too high, the air cell will be small. If humidity is too low, the air cell will be larger. Rundel finds that 12% to 15% egg weight loss over incubation is most successful, but a range of 12% to 20% weight loss has resulted in live hatches.[7]

Washing of eggs, as is typically done in the poultry industry, could potentially reduce the viability of cassowary eggs.[9] The eggs are usually kept relatively clean in the nest by the male.

Artificially incubated eggs can be candled to monitor development. Due to the dark pigmentation and shell thickness, an extremely strong light source and a completely darkened room are required. An egg with a viable embryo at 3 weeks' development

will have a clear shadow margin at the air space/liquid albumin compartments separated by the inner shell membrane (amnion). An infertile egg will have a hazy uneven shadow margin separating the air space/liquid albumin compartments with lucent streaks extending perpendicularly from the amnion in to the liquid albumin.

At 5 weeks, an infertile egg often will have a larger air cell than an egg containing a developing embryo. On rare occasions, an infertile egg will have a tiny air cell. Most artificially incubated live hatches have nearly exactly the same size air cell. An infertile egg will also cool faster during handling than a live egg after 5 weeks. Eggs are removed and observed daily after 6 weeks of incubation. Eggs are listened to, placed on a hard smooth surface to observe for movement, and checked for rate of cooling. By 65 days an egg may be removed from the incubator without prohibitive risk of discarding a viable embryo.

HATCHING

Hatching occurs between days 48 and 56. The egg will begin to have spontaneous movements, wiggling, spinning, or even hopping from 12 hours to as long as 14 days prior to hatching. This can be best observed by placing the egg on a smooth hard surface and closely monitoring it for 10 minutes.

Stages of Hatching

Just before hatching begins, a normal cassowary embryo assumes the hatching position with its head below the air cell close to the right wing tip. This is similar to other avian embryos. Internal pipping occurs toward the end of this stage.

It is assumed that a buildup of CO_2 causes the hatching muscle in the neck of the cassowary embryo to twitch. This is common to amniotes. This twitch causes the beak to penetrate the chorioallantoic membrane (ie, internal pip). At this point, the embryo becomes a chick—defined as such when it begins to breathe air within the air cell. A chirping sound may be heard from the egg as the lungs begin to function.[9]

Twitching of the abdominal muscles, which occurs secondary to breathing, causes the exteriorized yolk sac to be drawn into the chick's abdomen and cracking of the shell. This is the equivalent of external pipping, as cassowary chicks do not have an egg tooth with which to pip. With subsequent breaths, the level of CO_2 within the air cell rises. External "pipping" needs to happen soon to prevent death from suffocation.

Unlike psittacines, which are moved to a hatcher, cassowary eggs should remain in the incubator at 57% to 64% humidity. Humidity above 80% during hatching can result in edematous chicks that drown within the egg. Environmental parameters during hatching should not be altered from those during incubation as with other species. Additionally, at this time, turning of the egg should cease and it should be placed on the bottom of the incubator.

If the chick is unable to hatch within 1 to 2 hours, assistance should be provided. This procedure should be initiated only after a chick's chirping is heard within the air cell. To do so, identify the air cell by candling, and swab with 4% chlorhexidine solution and then open the center of the air cell with a sterile punch. Snip a small opening in the outer shell membrane with sterile surgical scissors and then very carefully break off bits of shell to open the air cell. Exercise care not to cause bleeding of the outer shell membrane (allantoic) and to avoid contaminating or injuring the chick with the instruments (**Fig. 10**).

Normally, the chick then emerges on its own unassisted. Most chicks chirp loudly while sitting on very large bellies filled with yolk. Often the yolk sac is too large for the chick to stand the first day or 2. Most chicks stand by day 2 as the yolk sac is absorbed. Nearly all chicks can stand by day 3. Some, however, walk early within

Fig. 10. Assisted hatching.

hours of hatching. In the wild, all chicks are up within hours of hatching. Posthatch activity does depend on clutch size as the male will not leave the nest until all chicks are hatched. In general, cassowary chicks in captivity may take 6 hours to 3 days to walk after hatching (**Fig. 11**).

Embryo and Chick Mortality

During early incubation, mortality may result from numerous factors, including failure of the parents and/or the artificial incubator.[9] Some common causes are improperly incubated eggs, inbreeding, genetic abnormalities, egg-borne infections, or contamination.

Additional causes of early embryonic death during artificial incubation include improper handling, excessive or insufficient temperature or humidity, excessive vibrations, improper egg turning, poor ventilation resulting in hypercapneic levels of CO_2, and malpositioning.[9]

Two of the most common malpositions are having the head aberrantly located at the small end of the egg or having the beak rotated away from the air cell. Eggs incubated below optimum temperatures develop more slowly and typically have

Fig. 11. Newly hatched chick.

increased problems with hatching. High or low humidity can result in the complications previously mentioned.[9]

All dead eggs should be necropsied. During the gross necropsy, the embryo's general condition and position are assessed. Abnormal tissues and fluids are cultured and/or sent off for histopathology. The shell is examined for color, texture, shape, and the presence or absence of stress lines. Thickness of the shell and degree of porosity are assessed by differences in texture.[9]

Hatchlings

Hatchling walking surfaces should be very soft and not slippery. Foam camping pads under towels are ideal. Heat lamps 18 inches above the floor keep the chicks warm. Chicks can lie under the light or move if they get too warm. Warm chicks lie down to sleep. Cold chicks cry and run around looking for warmth. A standard poultry waterer and small plate work well for watering and feeding.

Older siblings may reject younger nest mates. Eggs are laid 3 to 8 days apart. Hatchings are similarly spaced, so chicks will be of different ages. Chicks do imprint at this stage. A cassowary that imprints on a human may not breed with its own species and kill other members in the same enclosure. Care should be taken to minimize opportunity for chicks to imprint on keepers. In wild clutches, hatching is synchronized by delaying brooding and incubation until the last egg is laid.

The Pen

Incubator-hatched cassowary chicks should be kept in a climate-controlled space in captivity. The temperature should be maintained at 82°F (27°C) with 45% humidity. These spaces or pens should be fitted with appropriate footing as described earlier. Having the chicks on a surface that is too hard or slippery may cause injury to the hock or tibial-tarsal joint (**Fig. 12**).

Once the chicks reach 8 to 10 lb, they can be moved to a larger protected area fitted with rubber mats. After 1 year of age and a weight of about 40 lb, they can be moved to an outdoor habitat (**Fig. 13**).

Diet

Most chicks will not start eating until day 2 or 3, but some start on day 1. In the first 3 to 6 weeks, their appetites increase. The diet is predominantly composed of

Fig. 12. Chicks in their padded playpen.

Fig. 13. Stable with rubber mats and 6-month-old chicks.

fruit (**Box 1**). A diet too high in protein may cause joint deformities (see Perosis). The chicks should finish their entire feeding in 30 minutes. After about the first 10 minutes of the meal, partially digested food passes from the cloaca as feces to be eaten again. In this way the food makes at least 4 to 6 passes through the entire digestive tract over 3 to 5 hours. After repeated processing, the waste loses its fruity color and appeal and is finally ignored. The authors speculate that this is a food gathering strategy in the wild as pet cassowaries in New Guinea households are observed to return in the same cache outside to excrete.

Coloring

Hatched chicks have gold and dark brown striped downy feathers covering the head and body. The legs and feet are pink. The casque spot is flat (**Fig. 15**).

By 12 weeks, the stripes fade to a solid golden brown, quite similar to the coloring of Sand hill crane chicks of the same age. The down disappears from the head from the top downward and the casque begins to dome (**Fig. 16**).

Fig. 14. Typical adult meal.

Box 1
Diet at different ages

Days 1–3 hatching

- Typically do not eat or drink for 1–3 days

Days 4–7

- 3 tablespoons very small berries, minced fruit 5–10 mm in diameter daily
- Will scoop water with their beaks

Days 8–15

- 4 tablespoons very small berries, minced fruit including elderberries, raspberries, blueberries, blackberries, minced grapes, minced guava, minced banana, watermelon, cantaloupe, minced kiwifruit 5 to 10 mm in diameter daily
- 2–3 pellets of soaked puppy chow daily
- ¼ teaspoon shaved cuttlebone sprinkled on food daily
- Chicks will eat their clutch-mates' and their own feces.

Days 16–30

- 1 cup very small berries, minced fruit 5–10 mm in diameter daily
- 6 pellets of soaked puppy chow daily
- ¼ teaspoon shaved cuttlebone sprinkled on food daily
- ½ cup fine chopped baby greens daily
- Chicks will eat their clutch-mates' and their own feces.

Days 31–60

- 2–3 cups very small berries, minced fruit 8–15 mm in diameter daily
- 12 pellets of soaked puppy chow daily
- ½ teaspoon shaved cuttlebone sprinkled on food daily
- 1 cup fine chopped baby greens daily
- Chicks will eat their clutch-mates' and their own feces.

Days 60–90

- 2 cups halved grapes, cherries, 2-cm melon, banana, papaya, and guava chunks, whole raspberries, blackberries, blueberries
- 12 pellets of soaked puppy chow daily
- ½ teaspoon shaved cuttlebone sprinkled on food daily
- 1 cup fine chopped baby greens daily
- Chicks will eat their clutch-mates' and their own feces

Days 91–120

- 2½–3 cups halved grapes, cherries, 2-cm melon, banana, papaya, and guava chunks, whole raspberries, blackberries, blueberries
- 16 pellets of soaked puppy chow daily
- 1 teaspoon shaved cuttlebone sprinkled on food daily
- 2 cups fine chopped baby greens daily
- Chicks will eat their clutch-mates' and their own feces

121 Days to 6 months

- 4 cups whole grapes, cherries, strawberries, melon and papaya wedges for pecking, whole peeled banana and guava chunks, whole raspberries, blackberries, and blueberries
- 1 cup pellets of soaked puppy chow daily
- 1 teaspoon shaved cuttlebone sprinkled on food daily
- 3–4 cups whole baby greens daily
- Chicks will eat their clutch-mates' and their own feces

6–18 Months

- 2 gallons of any peeled fruit or berries (except avocado) in 5-cm pie
- 3 cups high protein dog food, fish food, or monkey chow daily
- 4–5 cups whole greens daily
- Chicks will eat their clutch-mates' and their own feces.

19 months to adults

- 5 gallons of peeled fruit, peeled melon halves, bananas. Nearly any produce is relished.
- 4 cups high protein dog food, fish food, or monkey chow daily
- All greens available
- Have not been observed to ingest gastroliths. We have not seen either adults or juveniles swallow foreign bodies.

Fig. 14 displays typical meal for an adult

By 12 months, the feathers will start to turn black and the skin of the head and wattles will start to acquire a blue and red color. The head and neck are nearly bald, and the casque becomes more prominent. The skin of the legs darkens to a charcoal gray (**Fig. 17**).

By 3 years, the cassowaries have deep vibrant adult coloring (glossy black feathers and iridescent blue, red, yellow, and orange coloring of the skin of the head, neck and wattle). The casque is now 3 to 5 inches tall.

Fig. 15. One-week-old chick.

Fig. 16. Twelve-week-old chicks with golden breast feathers.

Physical Examination

Cassowary hatchlings are precocial. Physical examination of the chick entails assessing overall appearance, proportions, weight changes, gait, activity joint swelling, and social behavior. It is important to monitor for normal eating, defecating, color, consistency, and volume of its droppings and coprophagia.[8–11]

Remove abnormal chicks from the clutch early to prevent infection of the group and allow a more thorough evaluation. A chick that stops eating, becomes weak, is unable to stand, or inflates its neck air sacs (a distress display) may be demonstrating signs of an illness, injury or congenital malformation. A treatment plan may then be developed based on specific problems present. Delay of appropriate treatment may lead to mortality.[8–11]

Common Pediatric Problems

Unretracted yolk sac

Unretracted yolk sac has been seen most commonly in malpositioned chicks. Hatching may begin as soon as 12 hours and as late as 3 weeks after the first egg

Fig. 17. Yearling chicks.

Fig. 18. Splay leg deformity.

movement is observed. Thus it is best to leave them unassisted until they are peeping in the air cell to avoid intervening prematurely. Premature intervention commonly results in an unretracted yolk sac and an underdeveloped chick. The yolk sac, a diverticulum of the small intestine, is normally internalized into the abdomen before hatching. The yolk sac is absorbed over the next few days, providing the chicks with nourishment and maternal antibodies. A prolonged retention of the yolk sac within the coelom can occur in cassowary chicks.[8–10]

Chicks with unretracted yolk sacs, and therefore an open umbilicus, should be placed on clean towels in the incubator and their umbilicus swabbed with chlorhexidine scrub. Crop and cloacal cultures should be taken, as well as yolk sac cultures if the latter is leaking. Chicks should be placed on appropriate antibiotics and oral antifungals. Chicks should also be treated with fluids. If the yolk sac fails to become internalized over 2 days, then surgery is necessary to amputate or remove the yolk sac.[8–10]

Splay leg deformities

Abduction at the stifle joint is a common deformity upon hatching often referred to as splay leg. One possible cause hypothesized is larger yolk sacs force apart the cassowary chick's legs (**Fig. 18**).

Splay leg is most common in the first 2 or 3 chicks of the season. Usually 1 leg is affected but both can be involved. Treatment is generally successful with bandaging techniques. This is done by hobbling with bandage tape (above the hock) for 3 days and observing closely for correct alignment.[8,9]

Perosis

Juveniles may also experience perosis or subluxation of the extensor tendon out of the tibial tarsal groove. Slippery or unpadded surfaces, trauma to the delicate joint capsule, and diets too high in protein and calories are suspect. The joint capsule, tendons, and articular surfaces are very delicate. Slipping and striking the tibial tarsal joint directly can cause rupture of the joint capsule. Direct injury to the extensor tendon can cause it to swell and result in subluxation, forcing it out of the tibial tarsal groove. Heel strike on a hard surface can cause the posterior articular tarsal groove to swell and thus cause the groove to "fill in," forcing out the extensor tendon. The tendon can be pushed laterally or medially. Clinical signs include hock swelling, limping, pronation, and inability of the chick to stand and extend the hock joint. A similar surgical procedure can be used for correction of either deformity.[5]

Some presubluxations with swollen joint capsules may respond to improved padded walking surfaces that allow more foot traction and absorb shock. Subtle subluxations also may respond to improved footing combined with physical therapy. This physical therapy also includes moving the birds to larger pens and encouraging increased walking and running activity. Exercise on safe walking surfaces is known to be of importance in such cases. Without external stimulation to move about, chicks that remained less or inactive would stop gaining weight and decline in health. While birds sustaining severe subluxations are typically euthanized, surgical correction of severe subluxations as a means of providing weight-bearing function is possible. This procedure has often proved effective reducing the need for euthanasia.

Perosis, also known as slipped tendon, results in a swollen hock creating a deformity of the medial tarsal and tarsal metatarsal bones. The tendon can luxate medially or laterally. Luxations can create joint deformities that render the limb incapable of normal weight bearing.

For surgical correction, a lateral paramedian incision is made through the skin over the caudolateral aspect of the joint midway between the lateral condyle of the tibiotarsus and the displaced tendon. The incision extends in a proximal and distal direction over the tibial tarsal joint to expose the displaced tendon. The tendon is dissected free from any trochlear and medial adhesions to the skin and subcutaneous tissues. Once the tendon is freed, make a lateral incision over the joint capsule to expose the tibial tarsal joint. Subsequently, dissect the tendon free of any additional medial attachments to alleviate tension that may pull the tendon from the trochlear groove. Begin this stage with freeing the tendon proximally from the tibial tarsal bone—similar to a quadriceps release. The trochlear groove should be examined and, if it is shallow, a block wedge resection can be performed easily with a scalpel blade to deepen the groove, which will assist in maintaining reduction. The tendon is then replaced to its normal position within the trochlear groove of the tibial tarsal joint. The tendon contains a sesamoid bone that resides in the trochlear groove of the tibial tarsal joint. The tendon is then secured in its normal position in the trochlear groove by suturing the tendon sheath to the lateral retinaculum of the joint capsule and periostium with 3-0 absorbable suture in a simple interrupted pattern. Last, close the skin in a single layer with an interrupted pattern using a 3-0 nonabsorbable suture. The leg is bandaged routinely and splinted using a tongue depressor. Change the bandage weekly for 2 to 3 weeks before final removal of the dressing.

Eye malformation

Unilateral micro-ophthalmia has been noted in cassowaries (n = 1). No other complications were associated. The affected chick was viable and grew to adult size.

REPRODUCTIVE DISEASES AND BEHAVIORS

Female

Infertility

Infertility of the female cassowary may be due to nutritional issues such as a diet deficient in fruit. Female cassowaries tend to become more aggressive and irritable a few hours before egg laying. Eggs are typically laid in the afternoon.

Egg binding and dystocia

Egg binding, the most common obstetric complication of birds, has been noted in captive cassowaries. Egg binding can lead to death in the untreated hen. The typical cassowary egg-laying interval is between 3 and 8 days.

Dystocia, the mechanical obstruction of an egg in the caudal reproductive tract, which can result in cloacal impaction and/or prolapse, has also been seen and corrected in captive cassowaries. The handlers at the Rundel collection in Sonoma manually replace a prolapsed cloaca using a manual reduction technique similar to that used by cattlemen for a prolapsed uterus in a cow. This technique was used to allow treatment without veterinary assistance.

Male

Infertility

Infertility of the male cassowary may be due to a nutritional issue such as a diet deficient in fruit. Males also can be intimidated by an aggressive domineering female cassowary and not copulate with her.

Inbreeding

Inbreeding has been observed to be associated with poor chick viability in captivity.

SUMMARY

Abduction at the stifle joint is a common deformity upon hatching often referred to as splay leg. One possible cause hypothesized is larger yolk sacs force apart the cassowary chick's legs (see **Fig. 17**). Splay leg is most common in the first 2 or 3 chicks of the season. Usually 1 leg is affected but both can be involved. Treatment is generally successful with bandaging techniques. This is done by hobbling with bandage tape. (above the hock) for 3 days and observing closely for correct alignment.[8,10]

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