Prenatal Medical Management

PART II

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Chick Rescue Techniques

An important aspect of hatching management is the ability to assist a developing embryo or hatching chick in trouble that would die of malpositioning or a disease process unless the aviculturist intervenes. This is an acquired skill that requires great experience and timing and has received little attention in the literature. The decision to intervene and to what degree is unique to each situation. The frequency for which embryo assistance is required is directly related to breeder flock and incubator management, as the most common causes are due to improper egg positioning, hen malnutrition, inappropriate incubator temperature and/or humidity and lack of embryo development, including water loss rate. Those aviculturists who have become skilled in embryo assistance also report progressively fewer numbers of eggs that require their assistance once a pattern and a cause has been identified. In the meantime, these techniques should help those chicks survive who would otherwise be lost to aviculture and the farm for which they provide revenues.

Transpiration Modification

Once a discrepancy in water loss has been identified, either through weight loss measurement, decreased movement or inappropriate air cell changes, the breeder can promote or retard water loss by the egg in the following ways:

Many aviculturists will run two or three incubators simultaneously to accommodate normal, wet and dehydrated eggs where the relative humidities may be used to counter abnormal water status. Other techniques include sanding down the shell at the large end of eggs retaining water or even opening a small hole over the air cell and capping the hole with a piece of cellophane tape which may be pulled back or sealed as needed to expedite water loss. Sealing small portions of the shell pores by lightly painting the shell areas with paraffin wax will assist in decreasing transpiration when multiple incubators are not available. The first eggs of parrot clutches frequently have slightly thicker shells than the last eggs if clutch size is large. This is assumed to be a function for increased survival as the first laid eggs may lie unattended for several days until clutching is completed, and, therefore, will prevent excessive water loss. This may result in the eggs from a single clutch requiring different artificial hatching conditions. One highly respected aviculturist has been very successful in using a low tech approach to embryos with dehydration. Eggs found to be going light are kept in ziplock bags to reduce transpiration. Cotton balls wetted with distilled water will further enhance the water retention of the affected eggs.

For those eggs that are drying too quickly, especially noted when holes have been opened over the air cell and transpiration accelerated beyond normal, the albumen will thicken due to dehydration while the yolk sac absorption is retarded, leading to weak chicks forced to struggle in a viscous environment. Occasionally, it is necessary to artificially rehydrate the chick. Distilled water dropped onto the air cell membrane, one drop at a time every six to eight hours over a four or five day period, will successfully return the egg's hydration status to normal. Experimental efforts with saline and LRS have proven fatal and it is assumed that the introduction of additional electrolytes is responsible. Unlike dehydrated neonates or juveniles, there is no concurrent loss of electrolytes through the shell. Success is determined by reverse air cell drop and candling the egg for increased vigor of movements. Be very careful about the volume and frequency of distilled water addition, as over hydration is easy to achieve.

Embryonic Medicine and Surgery

The addition of antibiotics and antifungals by injection into the allantoic cavity and/or the yolk sac has been successfully used by several practitioners for bacterial and fungal infections. Pipercillen (200 mg/cc) injected into macaw eggs at 14, 18 and 22 days of incubation survived both needle intrusion and antibiotic complications. Cockatoo eggs injected in a similar fashion with a 27 gauge needle via the air cell also survived. Infections may be indicated by decreased chick movement or black discoloration of the egg. This should be differentiated from the dark brown color noted just prior to hatch where the membranous vascular system begins to cease to function. No strict dose recommendations can be made at this time due to the difference in physiology between embryos and juveniles. The incidence of these diseases is rare with good husbandry and due to the fact that the albumen is rich in lysozyme, which is highly antibacterial.

Malpositioned chicks should be identified by air cell shape monitoring, candling and chick movements. Those chicks whose placement prevents them from normal head entry

into the air cell should be assisted. Depending on the head position, the shell should be opened, either directly over the head to allow direct atmospheric respiration to occur, or the shell should be opened over the air cell and the egg membranes painted with distilled water to identify blood vessels present. The membrane may either be incised between the vessels to guide the beak and nostrils up into the air cell or may be peeled back using a wet cotton swab to prevent the nostrils from being covered and the chick suffocating. Sterile tweezers and forceps may be very helpful here.

Chicks that pip below the air cell line almost always die due to the tearing of one of the membranous blood vessels and subsequently hemorrhage. Normal chicks usually initiate their pipping at a point just above the membrane line in the air cell. In very rare cases, the application of surgical glues (i.e., Nexaband™ - Tri-Point Medical, Raleigh, NC or Vet-Bond™ - 3M Company) with or without the use of dilute epinephrine solution to the hemorrhage site through the shell may save some chicks. If efforts are made to peel back the shell over the face of a chick hatching abnormally, it is necessary to only open enough membrane to allow oral/nasal exposure. It is critical to wait until surrounding blood vessels constrict and become nonfunctional before further incision of the membrane is accomplished. The chick may rest uneventfully in this position as is necessary. The use of electrocautery, fingernail polish and airplane model glue have all proved highly destructive and/or fatal to unhatched chicks due to their delicate nature and the rapid absorption of toxic components directly into internal organs via the vascular system.

Unabsorbed yolk sacs that protrude significantly from the umbilicus, risk being torn during malposition hatch or due to vigorous hatching efforts. The small end of the egg shell may be opened to allow the feet to rest freely and prevent excessive struggling against membranes that may be stuck to the yolk sac until further absorption of yolk occurs. Yolk sacs that are clear of the egg may be coated lightly with an antibiotic ointment (i.e., Iodophor types) and a small square of Telfa™ burn pad (Johnson & Johnson Company) adhered to the ointment until the yolk sac retracts in

order to protect it from laceration and foreign body adherence.

Chicks that have prolonged hatching or are required to hatch in stages due to assistance with malpositioning will accumulate lactic acid in muscle tissues. Feeding unhatched chicks LRS with 2-1/2% dextrose provides energy and replaces lost fluids for continued hatching efforts.

Egg Borne Diseases of Significance

In ascertaining the causes of embryonic or neonatal mortality and morbidity, the following categories should be considered. They include both vertically and horizontally transmissible diseases.

1. *Noninfectious Disease:*

• Maternally derived egg nutrition: this subject covers a vast array of disease processes with the most common ones being hypocalcemia (thin shells), hypervitaminosis D_3 (renal toxicity) and excessive selenium (decreased hatchability and increased teratogenesis, especially of the extremities). Effects may not appear until late in development, even up to weaning or young adulthood (i.e., protein deficiency related heart disease and visceral gout in macaws).

• Genetics

• Breeder flock drug exposure:

Tetracyclines:

• overall decreased embryo size

• small limbs

• skeleton shows inhibition of mineralization and erosion of long bone cartilage

Chloramphenicol:

• doses as low as 0.5 mg. per egg leads to marked inhibition of growth and development of embryos with no gross deformities

Penicillins:

• may cause edema and hemorrhage in wings, legs and heads

Sulfas:

• possible embryo deformities, regressive liver changes, granular degeneration of urinary tubules, inhibition of general growth, enlarged heads, micro and macroophthalmia, hypoplasia of beak, ankylosis of knee and toe joints and short legs

• Egg handling:

Chips, cracks, dirty environments, continuous rotation in one direction

• Incubator management:

Excessive heat, humidity, dehydration, improper positioning, rough egg turning, etc.

• Inappropriate candling protocol:

Candle light too powerful, insufficient understanding of developmental signs noted at different stages of candling, candling too infrequently to document disease onset

• Chemical toxins:

Organophosphate exposure to hen can cause embryo defects such as skeletal abnormalities (i.e., scoliosis, lordosis, etc.) especially of cervical region due to affects of acetylcholinesterase. May also see micromelia, deformed beaks and abnormal feathering.

Diazanon may cause incomplete caudal ossification, stunting, scoliosis and lordosis.

Parathion may cause chick edema.

Pyrethreines and carbaryls are considered nontoxic and acceptable insecticides for breeder flocks.

Nicotine has been found to have an extremely marked effect on embryos through passive introduction by the assumed route of nicotine contaminated fingers to shells. Death is common.

Petroleum products in very tiny amounts (1-10 µl) of various crude and processed oils have been shown to be embryotoxic or teratogenic. Commercial road dust control oil was found to be extremely toxic.

Automotive exhaust fumes may have a severe impact when eggs are exposed. Carbon monoxide at 100 ppm will decrease hatchability by 21%. CO at 200 ppm will decrease hatchability by 83%. Catalytic converter treated exhaust had similar effects and reduction in survival and organ pathology has been noted.

2. *Infectious Disease:*

• Bacterial

Salmonella is commonly carried from contaminated nests and vents. Shedding in hens is documented to increase with the stress of breeding. Incubator spread is common. Egg shell penetration can occur in less than six minutes. Surviving chicks may be weak, small, gasping, pale and refuse to eat. Dead embryos will exhibit coagulated yolks, congested liver, kidney and spleen, pericarditis and generalized hemorrhage.

Staphylococcus has a variable influence on embryos. The younger the embryo, the more susceptible. Hemorrhagic encephalitis, hepatic necrosis are seen. Renal hemorrhage and endocarditis are possible.

E. coli is generally due to environmental contamination, particularly from the nest and/or incubator. It is possible that egg transmission may be accomplished through low level chronic oviduct infection of the hen. Generally diagnosed by yolk sac culture. Chicks generally die very late in incubation or early in perinatal period.

• Mycoplasma

This elusive organism is well documented in its presence in cockatiels and budgies and is a major vertically transmitted disease of poultry. Egg transmission in Neophema and Polytelis species is strongly suspected at this time. Documentation of its significance in large psittacines remains to be determined. Egg injections of enrofloxin are proposed for control and eradication in embryos.

• Chlamydia

Suspected of potential vertical transmission but never proven. Common contaminant of egg shells via feces. Neonate chicks very susceptible when exposed to infected shell upon hatch or fecal contaminated equipment or hands.

• Viral

PMV-1 may cause increased

embryo mortality via transovarian infection, but this is rare due to the reduced ability for egg production in the face of a Newcastle's outbreak. Horizontal infection is also possible leading to retarded neurogenesis and stunted embryo size. Embryonal mortality can easily reach 100% of eggs set.

Budgerigar Herpesvirus can cause decreased egg hatchability. Only documented for budgies to date.

Polyomavirus strongly suspected due to attempts to eliminate virus from nurseries. Associated with weak chicks, high infant morbidity/mortality. Embryonic mortality not documented to date.

P.B.F.D. is strongly suspected of being egg transmitted at this time based on research at the Schubot Research Center and the University of Georgia, School of Veterinary Medicine in their attempts to create PBFD free nurseries.

- Fungal

Aspergillus is a relatively rare occurrence with good husbandry, but an important disease associated with poor incubator management. Aspergillus can penetrate egg shells and egg explosions during incubation will contaminate neighboring eggs.

Egg Necropsy

Aviculturists are not trained to appreciate the tremendous amount of information available to their enterprise through routine egg necropsy. By the same token, avian veterinarians are generally not aware of the value of promoting egg and embryo necropsy. Therefore, no significant effort is expended to educate the average aviculturist in its benefits. Even though a majority of the diseases of psittacine embryos and their complex relationship with each general species grouping are not understood, a wealth of information is available when eggs are necropsied soon after death. The results will often identify what category of disease is present and whether it is infectious or man made. Diseases affecting fertility, early embryonic death and hatchability are hardly recognized in psittaculture today, but present a significant financial loss to the industry. Regardless of whether the cause is infectious or management related, the control of disease is nearly always rooted in a managerial decision. Flock reproductive pictures can be heavily influenced by the species involved as great variation exists in their reproductive potential, behavior and environmental management requirements. All relative assessments of success or failure must be made with this factor in mind. To what degree of fertility, hatchability and survivability of chicks is considered abnormal is only valid in relationship to the known normals for those species kept in significant numbers in captivity.

The collection and assessment of aviary records are crucial for the discovery of hatchery disease. The numbers of aviculturists keeping detailed reproductive records is generally so limited that the avian veterinarian finds it necessary to provide his avicultural clients with forms to be filled out to obtain pertinent information. The following information should be included in the production records to be kept on site:

Prior and current year's flock performance for:

- total eggs laid
- eggs per clutch
- clutches per year
- percent fertility
- hatchability
- chick survival
- necropsy records, including causes of egg failure and chick mortality

Veterinary maintenance service

Veterinary diagnostic and therapeutic programs

The review of these records should include an awareness of the accuracy, extent and quality of the support services involved. The degree of post mortem autolysis is often advanced in psittacine embryos due to the aviculturist's hesitancy to pull and open eggs if any possibility of a live chick being killed exists. The nature and sophistication of veterinary service must also be taken into consideration before a final plan of action should be suggested. It is vital that qualified avian embryologists and pathologists be used to obtain accurate diagnoses. Bacterial, viral and mycoplasma cultures should be taken at the time the egg is opened and prior to the embryo being necropsied or preserved in formalin for histopathology. Care should be used to open the large end of the egg by progressive removal of shell fragments. The chick position should be noted and head and limb position relative to the body recorded. The chick should be carefully removed from the shell to avoid yolk sac rupture as this is a valuable culture site for infectious organisms. Embryo weight should be noted before opening the body cavity. The tissues remaining within the shell should be examined for presence and quality of the circulatory tree, membranes, abnormal colors or odors. Cultures of both the internal chorioallantois and the outer shell membranes may provide valuable insight as to the origin of infectious agents. Gram positive bacteria are generally found on the eggshell surface, while the more pathogenic gram negative bacteria are statistically found more frequently within the membranes of the egg. The pathogenicity of the organism involved will greatly affect the gross and microscopic findings in the egg structures.

The analysis of the reproductive records and the lab data obtained from the ongoing case will help to place the disease process in one of the three following categories:

1. Infertility

Causes:

- parent breeder flock diet
- parent breeder behavior (i.e., unsexed pairs, shy males, inadequate

nest box security, poor flight design, etc.)
- toxins
- genetics

2. Early Embryonic Death
Causes:
- Infectious and noninfectious disease described above and below

3. Embryonic Morbidity
Causes:
- Infectious and noninfectious disease described above and below

Three main critical periods of embryonic disease are recognized in aviculture. These are associated with the vital onsets of particular phases of physiology unique to that stage of development. This allows for greater sensitivity to outside influence and infectious disase during these times.

1. *Early incubation.* Twenty-five (25%) percent of all embryonic mortality will occur within the first week (day 3 - 5) or less of incubation. This is due to the formation of the blood system and food utilization starting out primarily as carbohydrate uptake. Food use shifts to fats and proteins at approximately day five and any difficulties that occur with this transition or the waste elimination of these new products will lead to excess carbon dioxide, ammonia or lactic acid build up leading to weakness or death. Candling of the egg should begin by day five to evaluate for the presence of an active vascular system with its rosy red glow. Abnormal findings indicating problems would include thin shells, heat spots, blood rings, cracks and abnormal air cell position or shape.

2. *Mid incubation.* Approximately half way through the incubation period, any depletions of nutrients supplied by the hen in deficient quantity will have an effect on the rapidly developing chick and be expressed as deformity, weakness or death. Candling should identify positional problems, air cell defects in position or size and chick vitality by response to light stimulation and general color. Eggs will be darker than before as the enlarging chick starts to absorb more light on candling, but a healthy pink glow should persist. Black is an indicator of death.

3. *Perinatal period.* Any influence that affects the position of the chick, its emergence into the air cell to achieve atmospheric respiration or pulmonary function will adversely affect the chick's survival.

The following tables will assist in correlating specific disease causes with necropsy findings and case histories:

Breeder Flock Diet Deficiency Influences in Embryos*

DEFICIENT COMPONENT	EMBRYONIC DESCRIPTION
Vitamin A	2 - 3 day mortality. Failure to develop normal blood system
Vitamin D_3	Stunted chicks, soft bones, thin shells
Riboflavin	High mortality day 9 - 14, curled toes, stunted chicks
Pantothenic acid	Subcutaneous hemorrhage
Biotin	Short long bones (micromelia), short and twisted bones of appendages, syndactylism, bradygnathism, increased mortality day 1 - 7 and 18 - 21
Vitamin B_{12}	Heads between legs (malposition I), edema, curly toes, poor muscling, increased deaths day 8 - 14
Vitamin K	Hemorrhage in embryo and extraembryonal membranes
Vitamin E	Edema, increased mortality day 1 - 3, buphthalmia
Folacin	Same as Biotin, increased mortality day 18 - 21
Calcium	Reduced hatch, short and thick legs, short wings and lower mandible, pliable beak and legs, bulging forehead, edema of neck, and protruding abdomen
Phosphorus	Higher mortality at 14 - 18 days, soft beak and legs, reduced hatchability
Zinc	Skeletal abnormalities, wings and legs may be absent
Manganese	High mortality 18 - 21 days. Short wings and legs, abnormal head, parrot beak, retarded growth and edema
Selenium	Reduced hatchability, fluid under skin, exudative diathesis (edema)

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Chick and Embryo Disease Conditions

PATHOLOGICAL CONDITION	DIFFERENTIAL DIAGNOSIS
Eggs explode	Bacterial contamination of eggs Fungal contamination of eggs Improperly disinfected eggs Incubator contamination
Clear eggs	Infertile Improper preincubation egg storage Excessive egg fumigation Very early embryonic death
Bloodring (embryonic death 2 - 4 days)	Genetics Breeder flock infection Old eggs set for hatch Rough handling of hatching eggs Incubation temperature too high
Dead embryos week 2 of incubation	Improper breeder diet Breeder flock infection Eggs not cooled preincubation Incubation temperature too high Incubation temperature too low Electric power failure Erratic power surges Eggs not turned properly Poor ventilation (excess CO_2)
Air cell too small	Improper breeder diet Unusually large egg
Air cell too large	Unusually small eggs Humidity too low day 1 - 19
Chicks hatch too early	Temperature too high day 1 - 19 Humidity too high day 1 - 19 Eggs too small for chick Thermometer inaccurate Hatch time miscalculated (species variation)
Chicks hatch too late	Temperature too low day 1 - 19 Humidity too low day 1 - 19 Temperature too low in hatcher Old eggs set Eggs very large Thermometer inaccurate Hatch time miscalculated (species variation)
Chicks pip early	Temperature too high day 1 - 19 Humidity too low day 1 - 19
Chicks dead after pipping shell	Improper breeder diet Lethal genes Breeder flock disease Eggs incubated small end up Very thin shelled eggs Eggs not turned day 1 - 14 Eggs transferred to hatcher late Poor air circulation day 20 - 21 CO_2 levels too high day 20 - 21 Poor temperature control day 1 - 19 Temperature too high day 20 - 21 Humidity too low day 20 - 21
Fully developed embryo with beak not in air cell	Improper breeder diet Temperature too high day 1 - 10 Humidity too high day 19 - 21 Malposition
Fully developed embryo with beak in air cell	improper breeder diet Temperature too high day 20 - 21 Humidity too high day 20 - 21 Poor incubator circulation
Malpositions	Poor breeder diet Eggs set small end up Eggs set on side Odd shaped egg shells Continuous light in incubator Improper egg turning
Albumen sticking to chicks	Late transfer to hatcher Temperature too high day 20 - 21 Humidity too low day 20 - 21 Old eggs set Poor air circulation day 20 - 21 Insufficient oxygen in incubator
Chicks too small	Eggs laid in hot weather Unusually small eggs Thin egg shells High porosity egg shells Humidity low day 1 - 19
Chicks too large	Unusually large eggs Humidity too high day 1 - 19
Chick quality or clutch hatch time not uniform	Eggs from different species Variable egg size Eggs set at different ages Disease in parent flock Poor incubator air flow
Mushy chicks (edema)	Poor incubator sanitation Temperature too low day 1 - 19 Humidity too high day 20 - 21
Dehydrated chicks	Temperature too high day 1 - 21 Humidity too low day 20 - 21 Chicks left in incubator too long (after complete hatch)
Open umbilicus (dry)	Poor breeder diet Temperature too low in hatcher Humidity too high day 20 - 21 Extreme incubator temperature fluctuation
Open umbilicus (wet)	Infection Poor incubator sanitation
Crippled chicks	Poor breeder diet Poor temperature control day 1 - 21 Malpositioned
Crooked toes	Poor breeder diet Poor incubator temperature control
Splay legs	Hatcher floor too slick
Scissors beak	Genetics Fungal toxicosis Incubator temperature fluctuation
Wry neck	Incubator temperature fluctuation

* 21 day incubation period