Pediatrics: Science and Medicine

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There is some debate out there in avian medicine circles as to when reproductive medicine ends and pediatric medicine begins- and this author is intentionally including both areas for discussion, because the two are somewhat inter linked and interdependent. For the purposes of this paper, the two will be combined to provide a good review of pertinent reproductive anatomy, followed by embryology and normal and abnormal pediatrics.

The Female Reproductive Tract

The female reproductive tract consists of the left ovary and the left oviduct in most birds. The left and right ovary and oviducts develop embryologically as paired structures, but, after hatching, the right ovary and oviduct degenerate. If the left ovary and oviduct are removed from a chick before 30 days of age, the remnants of the right ovary will develop into an ovotestes. Two ovaries are noted in some birds of prey, but it is rare for the right ovary to be functional. The Brown Kiwi has two functional ovaries and one functional oviduct. In an exception to the general rule of one ovary, right and left ovaries have been observed in it least 16 orders of birds which are assumed to have only one ovary.

Ovary

The left ovary is located in the coelomic cavity cranial to the left kidney and adjacent to the adrenal gland. The ovary is attached to the dorsal body wall by the mesovarian ligament, which can have considerably large blood vessels during an active breeding cycle. Surgical access as well as threat of hemorrhage makes a psittacine ovariectomy a particularly challenging procedure in an adult hen. The ovarian arterial blood supply is usually from the ovario-oviductal branch of the left cranial renal artery, which comes from the descending aorta between the cranial mesenteric artery and the external lilac artery. The venous drainage is via two ovarian veins directly into the vena cava. The ovary of the mature bird will have a "grape cluster' appearance, wheras the immature hen will have a ovarian surface frequently described as "brain-like" in appearance.

The ovary histologically consists of two major portions: the medulla and the cortex. The medulla contains connective tissue, nerves, smooth muscle and blood vessels. The codex covers the medulla externally and contains the primary oocytes. These oocytes have developed from a set number of prenatal oogonia by the time the female bird has hatched. Within the ovarian cortex of the adult hen, several hundred to several thousand primary oocytes may be visible to the naked eye. About twelve

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thousand are visible microscopically. Very few of these will enter the stage of rapid growth and actually develop beyond the primary oocyte stage. Primary oocytes visible on the surface of the ovary are termed follicles, which pedain to the primary oocyte and its membranous covering. After completion of the rapid growth period, the primary oocyte undergoes two maturation divisions. The first division occurs about two hours prior to ovulation and forms the secondary oocyte and the first polar body. This first maturation division is meiotic, resulting in a secondary oocyte which contains one half the adult bird's number of chromosomes. The second maturation division which forms ovum and second polar body occurs in the oviduct. Penetration by the spermatozoan is probably needed before this division can be completed. Fertilization of the ovum occurs within 15 minutes of ovulation, and presumably occurs in the infundibular oviduct.

Ovarian developmental activity stages noted in the mature hen include: 1) Prenuptial acceleration - the enlargement of the ovarian follicles, 2) Culmination - Ovulation and oviposition, and 3) Refractory period - ovarian follicles reduce in size.

The budgerigar and the crow are examples of determinant layers, meaning that they lay a fixed number of eggs. Many other birds, including chickens, ducks and most large psittacines, are indeterminant layers, meaning that they will be quick to replace eggs that are lost from their clutch or are removed. Aviculturists take advantage of this physiologic trait of indeterminant laying and remove eggs from the nest for artificial incubation, knowing that the parents will often "double clutch". The success of the propagation efforts of the California Condor were, in large part, due to wise use of the double clutch phenomenon.

Oviduct

The left oviduct is attached to the dorsal body wall by the mesovarian ligament. Glandular development within the oviduct results in a thickening of its walls which differentiate it into five functional regions associated with egg formation. These portions are termed the infundibulum, magnum, isthmus, uterus and vagina.

Infundibulum

The infundibulum is the funnel shaped structure at the proximal end of the oviduct along with a very small portion of the tubular shaped proximal oviduct. The funnel shaped portion of the infundibulum forms an elongated slit which faces the ovary. The ovulated secondary oocyte is literally swallowed or "caught" by the funnel portion of the infundibulum. This "catching" process is facilitated by the adjacent air sac which tightly encloses the ovary and forms the "ovarian pocket", leaving only the direction of the infundibulum for easy movement of the secondary oocyte. Not all ovulated secondary oocytes are successfully captured or caught by the intundibulum. "internal laying" refers to some secondary oocytes that 'are lost into the body cavity where they are reabsorbed or potentially become involved in "egg yolk peritonitis". Penetration by spermatozoa occurs in the funnel of the infundibulum. Formation of the yolk membrane's outer layers probably begins in the tubular. portion of the infundibulum. These outer layers of yolk membrane are termed the chaiaziferous layer of albumen and the chalazae.

Magnum

The magnum is the longest and most coiled portion of the oviduct. It is distinguished by its greater external diameter and markedly thicker wall caused by the presence of numerous secretory glands which account for the prominent mucosal folds of the magnum. These glands secrete the thick albumen protein around the ovum. The stimulus to secrete albumen may be mechanical, arising from passage of the ovum along the magnum. Smooth muscle contraction peristaltically moves the ovum along the oviduct. In a sexually active bird, the magnum undergoes tremendous enlargement as compared in size to that of an inactive hen. Added length of the enlarged magnum causes a folding of the oviduct upon itself.

Isthmus

This region of the oviduct is shod and has less prominent mucosal folds than the magnum. The division between the magnum and the isthmus is marked by a thin translucent line which can be seen on the mucosal surface with the unaided eye in domestic fowl. The isthmus produces two shell membranes which are loosely secreted around the ovum and albumen.

Uterus

The uterus is initially a similar diameter as the isthmus, but rapidly expands to form a pouch which retains the egg during the entire podion of egg shell formation. There is a normal "rocking" motion of the egg in the uterus as the shell is formed, and the egg spins along its linear axis during its development.

Vagina

The short terminal portion of the oviduct immediately proximal to its junction with the urodeum is the vagina. Strong muscle of the vaginal wall and a well-developed muscular sphincter at the uterovaginal junction serve to expel the egg during oviposilion. The lining of the vagina has tubular crypts that act as "sperm nests" for storing sperm. The capacity for fertilization is retained for several weeks after a single insemination in domestic fowl as well as many other domestic bird species. Within minutes after insemination, sperm reaches the infundibulum, but they disappear within 24 hours, only to reappear within the lumen in smaller numbers at the time of each subsequent ovuiation. How sperm survive in the vagina or what causes them to be released is unknown.

Formation of the Egg

In domestic fowl, the time required for the egg to traverse the entire length of the oviduct is approximately 25 hours. Most yolk precursors are synthesized in the liver and transpoded to the ovarian codex hematogenously. The primary oocyte increased-in size as the yolk precursors are assembled in their cytoplasm. This dramatic increase in size of the primary oocyte is referred to as the stage of rapid. development. Approximately 15 minutes prior to ovulation, the primary oocyte goes through a maturation division to form the secondary oocyte and first polar body. Following ovulation the ovum passes through the infundibulum in approximately. 15 minutes. Fedilization most likely occurs in the infundibulum. During the passage through the infundibulum, the chalaziferous layer of albumen and chalazae are formed and directly surround the ovum. Both the chalazae and the chalazfferous layers are composed of thick or dense albumen. The chalazae connect to the chalazfferous layer and function to suspend the yolk between the two ends of the egg.

The egg takes about three hours to traverse the magnum, during which time it acquires albumen. Albumen is much less viscous than yolk, the solid component being composed almost entirely of protein. Albumen contributes to the aqueous environment of the embryo, has antibacterial propedies and is a source or nutrition for the embryo. The egg moves through the isthmus in approximately one and one half hours. The inner and outer shell membranes are formed during transit through the isthmus. The egg spends most of its total transit time in the uterus (approximately 20 hours). During the initial eight hours in the uterus, "plumping" occurs. This refers to the addition of watery solutions from selective uterine glands into the egg. The weight of the egg is doubled during this process and the albumen becomes multi-layered.

Following "plumping", calcification of the egg shell occurs relatively quickly, taking approximately 15 hours. The shell consists of the shell membranes, the testa and the cuticle. The air cell of the egg is formed by the separation of the two shell membranes at the apical end of the egg as the egg cools after laying. The bulk of the shell is the testa. The testa consists of an organized matrix of fine fibers and a far more bulky 98% solid inorganic component consisting mainly of calcite (calcium carbonate). Egg pores open on the surface of the shell and extend down to the shell membrane. Overlying the testa and pores is an extremely thin organic layer called the cuticle. The cuticle functions as a water repellent, reduces water loss from the egg and acts as a bacterial barrier. Egg color is due to the secretion of porphyrins by the uterine epithelium. The egg travels through the vagina in a matter of seconds during oviposition.

The Egg

The egg consists of a germinal disk, yolk, the membranes surrounding the yolk, albumen and a shell.

The germinal disk (blastoderm if fertilized, blastodisc if unfertilized) is a small disk of cytoplasm that can be seen on the surface of the yolk of a fresh egg as a circular, opaque white spot- approximately 3-4 mm in diameter in the domestic fowl.

The yolk is a thick viscous material containing about 50% solids. Of these solids, 99% are proteins (30% lipoproteins and phosphoproteins). Yolk provides the main source of nutrition for the developing embryo. There are two kinds of yolk - white and yellow. The white yolk is approximately **b** protein and **a** fat. The central area of white yolk in the ovum is called the latebra. The yellow yolk is approximately **b** fat and **a** protein. Yellow yolk can be laid down in alternating whitish and yellow strata, depending on diet of the hen-carotenoid pigments providing the yellow color. An ovum from a hen with a well balanced diet will display no stratifications in yellow yolk coloration.

The yolk membranes form a barrier between. the yolk and albumen which provides good mechanical strength but is permeable to water and salts. The yolk membranes consist of four layers from closest to the yolk: the Oocyte laminella and the Perivitelline lamina (derived from the follicle or the ovary) and the Continuous lamina and the Extravitelline lamina (from the oviduct soon after the egg has entered).

The chalaziferous layer is a thin layer of dense albumen which encloses the yolk membranes. The two chalazae are twisted strands of fine ovomucin fibers formed from the chalaziferous layers, and are secreted by the tubular portion of the infundibulum. The chalazae are continuous with the cha!aziterous layer and the dense albumen layer-forming a suspension device for suspending the ovum in the center of the egg. The albumen is much less viscous than the yolk. The solid component (dense albumen) of albumen is composed almost entirely of protein (ovomucin) and some mucin fibers. Thin albumen is more watery and contains less ovomucin and almost no mucin fibers. Albumen is secreted by the magnum and contributes to the aqueous environment of the embryo, has anti-bacterial properties, and in many if not all birds provides a source of nutrition for the developing embryo to consume.

The shell consists of the shell membranes, the testa and the cuticle. The inner and outer shell membranes separate during the cooling phase rollowing oviposition at the blunt end or the egg - allowing for the formation of the air cell. The outer shell membrane is firmly attached to the testa, and the inner shell membrane is fused to the albumen ligament of the dense layer of albumen. The testa is composed of an organic matrix and has an inorganic component as well. The inner organic matrix is termed the mamillary layer, and the outer and thicker organic matrix is termed the spongy layer. The mamillary cones are embedded into the outer shell membrane. The cuticle is a continuous layer of organic material (90% peptide) overlaying the testa, and provides protection from water penetration, reduces water losses, and acts as a barrier to bacteria. Most pigmentation of the egg occurs in the inorganic layers of the testa or in the cuticle.

Incubation

The Developing Egg and Embryo

The embryo is formed from a fertilized blastoderm or germinal spot on the ovum. Females carry the sex linked chromosome and are responsible for determining the sex of the avian embryo. Each ovum carries either a Z or W chromosome, wheras the male is ZZ, and his spermatozoa can contribute only a Z chromosome.

Three layers of membranes protect and segregate the developing embryo. The extra embryonic membranes consist of two layers - the ectoderm and mesoderm, or endoderm and mesoderm, depending on the interface or the individual membrane. As the blastoderm matures, the amnion grows out around the developing embryo to form the sac containing the amniotic fluid. The embryo develops suspended in this amniotic fluid, which is in turn surrounded by the amniotic membrane. The second concentric membrane, the chorion, expands to line the inner shell wall. The third membrane, the allantois, develops from the hind gut of the embryo and also lines the inner shell. The combined membranes are called the chorioallantois, and this highly vascu!arized surface acts as both respiratory and excretory systems for the embryo. Blood vessels of the chorioallantois carry oxygen from the shell lining to the embryo and bring carbon dioxide back to the surface. This inner shell lining then acts like a large, passive lung. Metabolic wastes are deposited in part as urate crystals within the allantois. The insoluble urates are the most biologically inert from of nitrogenous wastes. It birds, like mammals, excreted nitrogenous wastes as ammonia (urea), they could not reproduce by laying eggs: the toxic ammonia within the egg would quickly prove to be toxic to the developing embryo.

Incubation: Basic Requirements

The Nursery

The nursery is a separate anatomic entity of the closed aviary, which originates from the breeding aviary. Within the nursery is housed and incubated the highest concentration of avian life and the greatest risk of loss due to mechanical failure, human error, infectious disease or combinations of these three factors. The eggs and offspring in the nursery represent the yield of financial investment, hard work, time, knowledge and avicultural abilities of the owner. The potential impact of losses in the nursery can be devastating both emotionally and financially to the aviculturist. For the attending veterinarian serving the needs of the producing aviculturist, an acute and specific awareness or relative risk, financial investments and emotional status of their clients will most definitely have a role in their success.

Records

At the time of entry to the nursery, all eggs or chicks should have an individual record initiated and assigned. Closed banding is recommended as the most popular form of permanent identification, although microchip iraplantation may also be used in older chicks or some precocial chicks such as the ratite species. Eggs may be identified with pencil coding on their shells. Obviously, newly hatched chicks are not banded at that age, and care must be taken to maintain the identification of those chicks until they are large enough to be permanently identified.

Specific areas of value for hand feeding psittacine bird records should potentially include:

* Identification
* Species

* Parentage
* Date of hatch
* Date that hand feeding was initiated
* Formula being used
* Day of age
* Weight
* Volume fed Frequency of feeclings
* Comments

Artificial Incubation

Incubator room design

In those facilities that maintain separate incubation and nursery areas, a general floor plan should be established for the incubation area. This floor plan should allow a specific traffic pattern to be used to promote the efficient use of time and materials and also serve as a passive barrier to waste and contamination. The so called "spaghetti test" is a helpful aid toward establishing a fluid floor plan. By tracing the daily activity that will occur within a building for normal work tasks, the amount of overlapping and inefficiency of motion will become evident in a floor plan/entire facility analysis. If the projected foot traffic begins to resemble a "spaghetti ball", the relative risk of cross contamination and motion/time inefficiency should dictate a change in blueprints.

Traffic

A key consideration throughout the entire incubation process is traffic flow. Minimized traffic, particularly in the high risk areas such as the incubation and hatching rooms will allow for lower infectious disease risk as well as lower stress to the eggs and chicks. Controlled and minimized introduction of potential infectious pathogens into the room and incubator /hatcher is of key importance. Caretui thought is strongly recommended regarding how people, the eggs, visitors, etc are moving into and within the designated incubation area.

Egg storage

Most psittacine aviculturists will set eggs into the incubator on the same day that the egg is harvested from the nest. In part, this procedure originates from less knowledge about the specific date of lay, and this is a reality to a certain degree with psittacine aviculture. If the eggs are not yet set by the parents, and incubation has not started embryogenesis significantly, storage can be utilized to synchronize hatch groups. Once incubation has started either naturally or artificially, the eggs should not be cooled, as there is significant risk of embryonic mortality if the egg is warmed, cooled and then warmed again in that manner. Eggs should be stored ideally at approximately 59°F until they are set into the incubator.

During the initial period or egg cooling in storage or in the nest, the air cell develops from the separation or the inner and outer shell membranes. Minimal movement or vibrations of the eggs during both storage and incubation is important, as handling during storage and the initial aspects of development during early incubation can predispose to early embryonic mortality as well as malpositions.

Incubation

The three key factors that need to be simulated in an artificial environment for incubation are temperature, humidity and turning of the eggs. It is mandatory that all of these three factors be provided consistently by the incubator. Successful artificial incubation requires total commitment of attention to the details of record keeping, care and monitoring of the equipment, egg handling technique and brooder management. There are numerous testimonials available regarding specific incubator manufacturer choices, settings and techniques used. However ….. many of these testimonials are exactly opposite of each other!

It is very important for the operator of an incubator to listen to these testimonials and carefully try to separate fact from fiction.

The same goes for their attending veterinarian.

The "ideal" incubator

The ideal incubator serves as a "room within a room". The incubator should be able to provide its desired incubation parameters while resting in a thermostatically and humidity controlled room that remains independent of daily climactic conditions. Without this type of control, fluctuations should be expected within the incubator unit. Construction of this unit should be with nonporous materials for two reasons: improved temperature and humidity control and improved ability to effectively clean and sterilize.

Temperature:

The temperature settings of the incubator generally control the developmental speed of the embryo. Individual testimonials of temperatures ranging from 99.0-99.3°F (37.2-37.4°C) have proven successful for psittacine egg incubation. The heat of the incubator should be consistent, and uniformly distributed within the unit. Consistency and accuracy is attained by regularly monitoring temperature with multiple thermometers. It is not recommended that the operator "trust" any one thermometer or piece of monitoring equipment. Uniform distribution of temperature is accomplished through the air circulation (fan) system within the unit. Those units with low air turnover should be expected to vary in their ability to distribute temperature evenly throughout the unit particularly when the unit becomes progressively filled with eggs. Those incubators that have been altered for improved ventilation may actually have induced an increased temperature variability through increased heat loss.

Humidity:

Relative humidity controls the rate of weight loss of the egg dudng the incubation process. As the eggs are incubated, weight loss through water evaporation is a normal process. "Wet chicks" is a term used to describe chicks that have demonstrated inadequate weight loss during the incubation process. "Wet" altricial chicks tend not to show the classic edema demonstrated by precocial chicks, but may simply have a weaker than normal hatch, increased tendency to splay the legs and possibly immunosuppression linked problems. "Dry or sticky chicks" generally refers to those birds that have lost excessive weight during the incubation process.

Egg turning:

Rotation of the eggs is perhaps one of the most overlooked aspects of incubation. Turning the eggs is mandatory to allow for uniform development of the vascular supply of the embryo throughout the embryonic membranes. Without this web of vessels, the developing embryo will become deprived of adequate oxygen exchange and can potentially die. General poultry recommendations for egg turning are a 90 degree turn, a minimum or four times per day. The turning mechanism of the incubator should be smooth, as rough turning can be associated with an increase in early embryonic mortality.

Obviously, mechanical turning as well as hand turning Of eggs can potentially be too rough, resulting in an increase in embryonic mortality. Careful evaluation of the turning processes of an incubation system is strongly advised for this reason.

Weight loss calculations:

Egg weight losses can be calculated using the following formula:

1. Calculate the grams lost per day of incubation.

$$\frac{\text{starting weight} - \text{current weight}}{\text{days incubated}}$$

Example:

$$\frac{26.00\ g - 24.05\ g}{14\ days} = \frac{1.95\ g}{14\ days} = 0.14\ g/day$$

2. Calculate anticipated weight loss for the total incubation period. Grams lost / day X 28 days incubation period

   Example:

$$0.14\ g/day\ x\ 28\ day's\ incubation\ period = 3.9\ g$$

3. Calculate anticipated weight loss as a percentage of the original weight.

$$\frac{anticipated\ weight\ loss}{starting\ weight}\ x\ 100$$

   Example:

$$\frac{3.9\ g}{26.00\ g}\ x\ 100 = 15\%$$

Most avian species eggs lose in the range of 15% (13-16%) of their original weight during the incubation process. This weight loss is regular and consistent throughout the entire period, and as a result, these calculations allow for predictability of the ultimate percentage loss to be anticipated. This linear weight loss relationship is a grossly underutilized monitoring tool in psittacine egg artificial incubation at present time, and as a result, allowing for weight loss deficits to not to be easily recognized or prevented.

Hatching

Throughout the development of the embryo, the egg steadily loses water by transpiration through the chorioallantoic membrane. This wa ~ er loss is a linear and consistent event throughout the entire incubation process. Because of this loss of water and the loss or yolk fats metabolized during development, the egg is much lighter at hatching than when it was laid. In most avian species, the weight loss is approximately 15% of the original weight of the egg. The eggshell, too, is thinner than when it was laid because the chick has absorbed much of the calcium from the inner shell lining. In the imminent hatching period, the chick absorbs the remainder of the yolk sac into the abdominal cavity and also begins to swallow any remaining amniotic fluid that remains.

Two specialized structures found only in hatchlings aid the chick in its struggle to break open the shell. A small, sharp "egg tooth" develops on the dorsal tip of the rhinotheca and is used to "pip" and "cut" out of the shell. A substantial enlargement of the complexus muscle (pipping muscle) in the proximal dorsal cervical region helps to brace the neck and cushion the head as the chick forces the egg tooth through the shell. After hatching, most of the fluid within the complexus muscle is reabsorbed, and this muscle continues to function as an extender of the head in most adult birds. The egg tooth is lost in the first few weeks following hatching.

Immediately prior to the start of the hatching process, the air cell expands to encompass approximately 20-30% of the total internal egg volume. This change can be noted by candling, and is termed the "draw down". At the stad of the hatching process, the beak of the embryo penetrates the inner shell membrane where it forms the inner wall of the air cell, and the lungs become functional by inspiring air from the air cell. An increase in plasma CO_2 is associated with the trigger for the internal pipping process. The external pip occurs when the chick cracks or cuts the outer shell membrane and shell. Again, rising CO_2 in the air cell chamber serves as the trigger for the spastic neck and associated muscle contractions involved in the hatching process. In the domestic fowl a period of about 20 hours elapses between pipping and hatching. In non-domestic bird species, this time frame from internal pipping to hatch can normally range from six to up to 48 hours. Most parrot species normally hatch within a 24 hour period from internal pip to completed hatch.

Problems with the Hatch

The following chads are provided to furnish basic information that will allow for trouble shooting problem hatches. Keep in mind that the actions taken are based on overall incidences of problems, rather than isolated incidences. From a flock perspective, take caution about recommending that we throw out the baby with the wash!

Malposition Classification and Descriptions (Poultry)

Malposition l: Head is between the thighs (position assumed immediately prior to hatching position).

Malposition II: Head is in the small end or the egg. Approximately 50% of the embryos can hatch from this position if they do not suffocate. Manual intervention may help reduce modality rates associated with this position.

Malposition III: Head is toward or under the left wing instead of the right wing. This is a lethal position as the embryo tends to rotate counterclockwise to hatch which it cannot do in this position.

Malposition IV: The embryo is rotated with the beak away from the air cell. It is impossible to successfully hatch from this position, although the chick will often pip the shell and frequently pip a vessel and cause hemorrhage from the chorioallantoic vessels.

Malposition V: Chicks have their feet over their head. This position makes rotation very difficult and the embryo usually fails to hatch. This is an uncommon realposition in psittacine birds.

Malposition VI: The beak is above the right wing. This is a nonlethal variant of normal positioning.

Guidelines for Troubleshooting Problem Hatches

Observation	Possible Causes
Early Embryonic Mortality	Delayed egg collection High egg storage temperature Long egg storage time Infected eggs Breeder malnutrition Rough egg handling
Mid Embryonic Mortality	Breeder malnutrition Infected eggs Inadequate egg turning Rough egg handling
Late Embryonic Mortality	Breeder malnutrition Inadequate ventilation Infected eggs Fluctuating incubation temperature
No Internal Pip	Weak chicks Dry chicks Wet chicks Malposition Infected egg
Internal Pip and Death	Hatcher temperature too high Hatcher temperature too low Hatcher humidity too high Inadequate ventilation Lack of social stimulation
Early hatch	Incubation temperature too high Incubation humidity too low Small egg size
Late Hatch	Incubation temperature too low Large egg size
Malpositions	Inappropriate egg position Inadequate egg turning Rough egg handling Breeder malnutrition

Observation	Possible Causes
Malformed Chicks	Incubation temperature too high Breeder malnutrition Rough egg handling Chick malpositioning Genetic mutations Teratogens
"Wet Chicks"	Inadequate air circulation Excessive humidity Large egg size Thick egg shells Low egg shell porosity Breeder malnutrition
Small Chick Size	Incubation humidity too low Small sized eggs Thin eggshells Porous eggshells Genetic predisposition
"Sticky Chicks"	Incubation humidity too low
Externalized Yolk Sacs	Assisted hatching (premature) Infected eggs Breeder malnutrition Wet chicks Dry chicks Incubation temperature too high Fluctuating incubator temperatures
Yolk Sac Infections	Assisted hatching Inadequate umbilical care Unsanitary hatcher Infected eggs Inadequate egg harvesting technique

The Newborn Hatchling

Precocial (nidifugous) chicks hatch from the egg with open eyes and thick coats of natal down:they are strong enough to leave the nest within one or two days. Most shorebirds, ratites, game birds, gallinaceous birds and anseriformes have precociai chicks. Altricial chicks (nidicolous), however, are hatched blind and virtually naked. They require long periods of feeding before they are strong enough to leave the nest on their own. Most tree nesting and cavity nesting birds have altricial young, and all psittacine birds have altricial young. Precocial species tend to have larger egg sizes than altricial birds.

A Differential Diagnostic Approach to Common Pediatric Presentations

Most of the current literature relating to psittacine pediatrics describes the ailment and its subsequent treatment. There is usually a mention of "secondary disease" and primary managerial problems, but less emphasis on the real roots of the problem or how to "think out" a problem starling with the diagnosis. With this in mind, the following information is provided to stimulate thought as to the underlying causes (hence true cure potential) for several pediatric ailments. Keep in mind, that pediatric medicine, in many ways is an aspect of avicultural or flock medicine. The diagnosis and individual bird diagnosis leads towards potentially other thoughts and actions from the astute veterinary clinicjan.

Clinical Presentation	Differential Diagnostic Thoughts
1. Crop Stasis	Dehydration Formula too hot Formula too cold Hypomotility related to stunting Malnutrition Primary or secondary infectious disease "Sour crop"as a secondary complication Brooder temperature too high Brooder temperature too low Brooder humidity too low Exogenous stressors (light, etc) Foreign body obstruction *or* GI tract Normal variation in motility during 24 hr period Toxicoses
2. Regurgitation	Crop stasis Normal behavior for species and age Inadequate feeding practices Imbalanced brooder environment
3. Sinusitis	Inadequate brooder air quality Foreign objects in nares Primary or secondary infectious disease Inadequate feeding protocols
4. "Splay leg"	Inadequate brooder substrate Wet chicks Weak chicks Inattentive nursery management
5. Tibiotarsal rotation	"Splay leg" Traumatic injury Inattentive nursery management

Clinical Presentation	Differential Diagnostic Thoughts
6. Anteroflexed P1/P4	Stunting Inappropriate brooder substrate Malnutrition Inattentive nursery management
7. Constricted toe syndrome	Specific etiology not known Genetics? Humidity? Bacterial dermatitis/hypersensitivity?
8. Scissors beak deformity	Likely multifactorial Hand feeding trauma? Malnutrition? Sinusitis? Genetic predisposition?
9. "Diarrhoea"	Normal for age and species Bacterial imbalance /infection of GIT Enteritis Primary or secondary infections Over medication Malnutrition Hypermotility Hypomotility Pan systemic disease Parasitism?
10.Stunting	Malnutrition - Inadequate volume / day - Inadequate calories /day Crop stasis (1) Inattentive nursery management - Excessive brooder temperature - Inadequate brooder temperature - Inexperienced hand feeders Inadequate adult breeder parenting - Inexperience - Large interval between first/last hatch - Aviary disturbances - Infectious parental disease Infectious disease (primary or secondary)
11. Candidiasis	Crop stasis (1) Stunting (10) "Diarrhoea" (9)
12. Aspergillosis	Inadequate brooder air quality Immunosuppression Over medicatien Stunting (10)

Clinical Presentation	Differential Diagnostic Thoughts
13. Polyomaviral disease	Individual bird Exposure to virus (pre- or post-purchase) Immmunosuppression Violations of Closed Aviary Concept Traffic Epidemic (multiple birds) Seeding source of virus Amplification of virus in nursery Inadequate sanitation measures Immunosuppression (nursery practices)
14. PBFD	Individual bird Exposure to virus(pre or post purchase) Immunosuppression Violations of Closed Aviary Traffic Epidemic (multiple birds) Violations of Closed Aviary Concept Traffic Seeding source ot virus Amplification or virus in nursery Inadequate sanitation measures Immunosuppression (nursery practices)
15. Psittacosis	Individual bird Exposure to virus(pre or post purchase) Immunosuppression Violations of Closed Aviary Traffic Epidemic (multiple birds) Violations of Closed Aviary Concept Traffic Seeding source of the organism Amplification of the organism in nursery Inadequate sanitation measures Immunosuppression (nursery practices)

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