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PROLAPSE IN LAYING HENS: ITS PATHOPHYSIOLOGY AND MANAGEMENT : A REVIEW

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ABSTRACT

The egg industries have undergone significant transformation over the last four decades and it seems that this will persist, even though at a somewhat reduced rate, over the next 10 to 20 years. Because of advances in genetic selection, management and nutrition, the modern-day commercial layers have fast growth rates, high feed conversion ratios and metabolic rates. Layer production is undergoing change, in terms of potential for egg processing and more recently the start of major international trade in eggs. Despite such tremendous developments in layer nutrition and management some recurrent disorders are always present with some degree for most poultry species. Prolapse is one of such common disorders which invariably results in some economic loss each year. Prolapse in laying birds is the eversion of the oviduct and rectal organs through the vent to the extent that the organs don't retract. The condition perpetually results in death even if the prolapse is discovered and the organs replaced in position. Not only nutrition, but also several other factors like hormonal disturbances, managmental errors, Pathological factors and many moreare responsible for incidence of this disorder.Therefore, a comprehensive understanding of different causes and remedies of prolapse in laying hens is necessary to take appropriate and effective preventive measures, which is to ensure better economic profitability.

Key words: Layers, prolapse, oviduct, nutrition, management, cannibalism.

Egg production typically begins when the pullets reach 18-22 weeks of age, depending on the breed and season. A number of factors can adversely affect the egg production of a flock in which prolapse plays a prevailing role. Prolapse which causes low productivity in laying hens is a serious sickness. Prolapse in poultry is a condition in which the lower part of a hen's oviduct turns inside out and protrudes through the vent. When a hen lays an egg, the lower part of the oviduct is momentarily everted through the cloaca. Usually, the hen can retract the oviduct after laying. Prolapse occurs as the hen cannot retract the oviduct and a part of it remains outside the body[1, 21]. Prolapse is a very serious condition that is treatable if caught early and is likely to recur. Prolapse usually cause permanent damage to the hen and is fatal in many cases[6]. It is also named

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as Prolapse vent or oviduct or blow-out or cloacal prolapse or pickout.

Ancestors to the modern-day chicken laid 10 to 15 eggs a year[32]; while today's laying hens produce more than ten times of them[37]. So the pressure for higher egg production is a predisposing factor. In today's world, most consumer demand for extra-large and large size eggs i.e., jumbo eggs[19] and production of these eggs by small birds is one factor that may lead to cloacalprolapse[1, 21, 41] which can lead to hemorrhage, infection, and cloacal cannibalism[1, 25, 15]. It usually occurs due to loss of muscular tone when the bird is too fat and/or an egg is too large and the bird's reproductive tract is expelled with the egg.

Incidence

In a study conducted by Farooq[12], that prolapse was the second most prevalent problem and resulted in 12.1% mortality in the laying birds. Egg prolapse was one of the serious problems reported to cause 9.4% mortality in egg type layers[36]. This condition (also called as blow out) is most common in overweight, older hens and in early laying pullets of low body weight.

Pathophysiology of prolapse:

Sometimes the oviduct does not retract immediately once the egg is been laid. When a part of the oviduct is remaining outside the vent, it results in prolapse. Rectal prolapse is the protrusion of all layers of the rectum through the anal orifice as an elongated cylindrical mass[3]. The problem is not only prolapse, but due to prolapse, pecking or cannibalism can occur and high mortality may be the sequel. Other birds will peck at the protruding material, which can lead to hemorrhage, infection, and cloacal cannibalism[1, 25]. Affected birds are in terrible pain and they are not able to get rid of the egg. The mucosa soon dries out and necrosis occurs. The mucosa can be injured while the hen tries to help herself. In the worst case she can bleed to death. Another problem is that the hen is not able to defecate because the egg blocks the cloaca.

Etiology of prolapse and their preventive measures

A prolapse vent on a laying hen occurs when there is degeneration to the muscular system responsible for laying - it is a form of herniation[15]. Prolapse, in spite of, occurring due to increased egg production there are other factors which are also responsible for it. The major factors include intestinal infection, overweight in birds, age at sexual maturity, early photostimulation, unbalanced feed formulation and laying double yolked eggs. Use of unbalanced formulation in laying hens causes low egg production and increase of prolapse problem. The main parameters in feed formulations which help to prevent prolapse, are energy, protein together with calcium and phosphorus levels. Among the possible causes of higher mortality in egg type layers, egg prolapse also account for a significant number[12]. Recent reports suggest that problems associated with reproductive tract such as egg peritonitis, prolapse/ protrusion, cannibalism and vent pecking were seen as important causes of mortality in Australia[24]. Besides direct contribution towards mortality, cannibalism in the flock causes additional loss. Prolapse oviduct is a common reproductive tract problems encountered in egg laying birds[31]. The factors responsible for occurrence of this condition are described below.

Biological factors

Hormonal disturbances

Disturbances in normal hormonal status of laying birds results in occurrence of prolapse. Prolapse hens had significantly lower plasma 17â-estradiol concentrations than unaffected birds. Shemesh[34] reported that microsomes prepared from the uteri of prolapse hens converted significantly less arachidonic acid to prostaglandin metabolites (4.4%) than did microsomes from healthy birds (9.0%). Reduced peripheral estradiol concentration decreases the prostaglandin synthatase activity, which causes decreased prostaglandin level of oviduct[34]. Low prostaglandin level does not allow the activity of the smooth musculature of oviduct to its full extent[10] and thus predisposes the birds to prolapse. Of course, the hormonal regulation is indirectly related to the photostimulation and other

many factors which are described later. Estradiol benzoate in injectable form is used to treat the prolapse bird[34].

Cannibalism

Vent pecking (also called as cloacal cannibalism) is a cause as well as a consequence to prolapse in layer birds. Many forms of cannibalism come about in domestic fowl. Vent-pecking is one of the most widespread and severe forms of cannibalism[2, 14, 30]. Vent-pecking frequently leads to fatality within a very short period of time[8]. Cannibalism often becomes severe unless the birds have been properly beak-trimmed[23]. Vent-pecking is usually triggered by prolapse or tearing of the vaginal mucosa during passage of an abnormally large egg[30]. The cloacal membranes that become exposed after the expulsion of the egg sometimes attract other hens to peck at the vent[2]. As observed by Grimes[13], prolapse and cannibalism were correlated with reproductive maturity. In poorly developed (small body frame) and in obese birds, the uterus or vaginal mucosa, which normally everts during oviposition, may be slow to retract, thereby allowing cage or penmates to peck at the everted mucosa that eventually becomes traumatized[40]. Continuous irritation of the exposed mucosa often causes straining and overt prolapse of the oviduct.

Managemental factors

Housing of the birds

The pulling out of feathers of another bird is commonly observed in flocks kept in close confinement, whereas the pecking of the vent region is often observed in high-production pullet flocks that are kept in cages[30]. Vent-pecking has also been observed in loose housing systems[14]. Prolapse is more frequent in cage-based layers, as cannibalism remains one of the most common causes of mortality in these birds[39]. Too low feeder space provision has an effect to initiate the cannibalism behaviour of the birds and hence the prolapse condition is also aggravated[20]. Nests should be adequate in number and always dark inside. Nest boxes should be comfortable and kept in a row along the wall of the shed for the birds raised on deep litters. Nesting material should be as smooth as possible.

Early Photo stimulation

Light (natural or artificial) has a stimulating effect on the pituitary, resulting in secretion of FSH and LH, which activates the ovary. One major effect of light is altering the age of sexual maturity of pullets. It is not the intensity of light that causes the difference, but change in day length that alters the age that the first eggs are laid. The length of the day light should not be decreased for laying pullets. This problem arises when producers increasing day length to stimulate sexual maturity i.e., early sexual maturity. Birds that are exposed to increasing day length before the reproductive tract has fully matured are more likely to suffer from prolapse, because the reproductive tract may not be fully matured when they begin to lay. If pullets reach sexual maturity too early, an excessive number of small eggs and an increased incidence of prolapse will be a result[26]. As a preventive measure strict schedule should be followed i.e. chicks should be raised on 23hr light including day light for first three weeks. Then there should be a gradual drop in light hours till six weeks of age and then, no artificial light should be given till birds come into 25% productive stage. Once this stage has come, then only the artificial light should be given and increased ½ hr weekly for the first 2 weeks followed by 1/4hr weekly till total light has reached at 16hrs (both natural and artificial) a day. After six months of laying if required, light hour may be increased to a total of 17hrs a day, but no more.

Photo duration and intensity

Excess light also influences birds to take more feed, which induces forced laying and thus prolapse. Hens require 14 hours of day length to sustain egg production[6]. Sudden increases in day light results in big sized eggs (jumbo eggs) that can result in prolapse. Once day length drops below 12 hours, production will decrease and frequently stop. The lights should be added in the

morning hours so the birds can go to roost as the sun sets. This prevents birds from being stranded in the dark when lights are turned out during dark hours[6]. As a preventive, there should be a provision for artificial light to maintain a constant exposure of light for at least 14 hours per day. One 40 watt light for each 100 square feet of coop is adequate.

Fluctuations in photoduration

Fluctuation in lighting pattern should be avoided to reduce chances of moulting and low egg production[26]. Also decrease in total light for laying birds is not desirable. Artificial light should be given equally in the morning and evening. Morning light is important in the summer to encourage the feeding during cool hours.

Light intensity

The intensity of the light should not be excess, rather it should just be sufficient for the birds to take feed and water[6, 26]. Under high light intensity conditions, birds are more likely to see and be attracted to the everted oviduct and thus more likely to peck at it and cause damage. Generally bulbs of 25 watt should be fixed with good reflectors at 7-8 feet above the floor and these should be evenly distributed in the farm house at 8-12 feet distance.

Overcrowding in the pen

More density of birds in a limited area results in lower feeding space availability, which in turn increases the chances of cannibalism and thus aggravates the prolapse conditions[20, 30]. Stocking density/Birds should be at least 2 sq. feet of floor space.

Improper debeaking

Debeaking is a method for prevention of vent pecking by penmates. This protects the prolapse birds from cannibalism by pen mates[8]. Proper debeaking at 10 days followed by beak trimming at about 85 days of age, and prior to laying at about 128 days of age may prevent the severity and secondary complications of affected birds.

Nutritional factors

Feeding the laying hens with nutritionally unbalanced feeds causes low egg production and also increases the incidences of prolapse[6, 30]. In cage layers the lack of exercise, results in excessive deposition of body fat, causing body obesity. Between the pubic and lower abdominal fat oppression of a large number of the fallopian tubes, blocking the birth canal, excessive muscle tension in the fallopian tubes, each responsible for egg production are a result of strong efforts to rectal prolapse.

Low protein diet[9] and low sodium intake[7] have been found to result in high mortality rate and unsatisfactory plumage condition. On post-natal hen, egg production remains rising, at this time if high-protein diet is fed, there is sharp increase in egg production and egg weight or appearance of more double yolk eggs, and therefore the incidence of rectal prolapse becomes obvious. Esmail[11] and Bearse[4] observed that cannibalism is reduced in a dose-dependent manner when the crude fiber content of the diet is gradually increased. Wahlstrom[38] also found that the total mortality due to cannibalism in birds given oat-based diets was lower than those given wheat-based diets. Salih[33] reported that ingestion of soluble dietary fiber increased digesta viscosity and reduced rate of feed passage. These properties may result in increasing the feeling of fullness[29], which in turn may increase the cannibalistic behavior of birds. In addition, calcium-rich diet or diet with imbalanced calcium:phosphorus ratio results in poor absorbance of calcium in the intestinal tract. Thus the unabsorbed calcium stimulates intestinal inflammation activating forceful effort of the bird to defecate, which in turn can cause prolapse. Ray[28] reported a numerical variation in serum calcium and phosphorus level as affected by source of microminerals (Cu, Zn, Mn) in Japanese quails. Hence micromineral level and source may also influence the occurrence of prolapse in laying hens. Low dietary salt is also a major cause for incidence of prolapse, as low sodium level aggravates cannibalism in birds[18]. Vit.A and E deficiency results in keratinization and loss of elasticity of fallopian tube and cloacalmucosa thatmay exaggerate cloacal prolapse. All these

factors are to be taken care of before formulating the feed.

Dietary management of weight

Overweight birds are more prone to prolapse due to general muscle weakness, a tendency to lay larger eggs[27] and due to early sexual maturity[5]. Restriction of weight gain by increased house temperature, lower feed energy level, proper calcium to phosphorus ratio and intermittent lighting programme is of immense importance for weight management at different stages of layer birds. Excessive weight gain either in growing stage or after onset of lay due to improper feed formulation results in prolapse. High energy and protein diet like chick mash feed even in growing stage results in early maturity of the birds resulting in prolapse. High energy diet also results in fat deposition in the bird and too much fat around the reproductive organs can also lead to prolapse. So Regular body weight measurement is necessary and they should be grouped according to their body weights and accordingly should be fed with suitable energy levels. Birds that are underweight with respect to their stage at the time of laying, are more likely to suffer from prolapse as reproductive tract has not matured completely. Hence early maturity either due to faulty feeding or over feeding or light stimulation should be avoided. So careful monitoring of feed energy level is always a better preventive for both overweight and underweight conditions along with fat deposition in the reproductive tract.

Pathological factors

The pathological factors may be enteritis, constipation, high ecto and endoparasite infestation causing irritation and discomfort to the birds. Ticks, lice, mites causing irritation around the vent add to the discomfort of the birds causing prolapse vent. Some specific diseases cause weakening of the oviduct and immunodepression. e.g., IB (Infectious bronchitis), EDS (Egg drop syndrome), RD (Raniketh disease - to lesser extent) and Merek's disease (enlarged liver, kidney, spleen and thickened intestine exert pressure on the oviduct and thus causing pressure atrophy)[6]. All the above diseases results in internal laying, egg bound condition, egg peritonitis and prolapse conditions.

The best possible protection against disease is to buy healthy stock and keep them isolated from other birds. While introducing new stock to farm, chicks from a reputable hatchery should be purchased as adult birds can look healthy but may be the carrier for many diseases[6]. Regular faecal sample test for intestinal disorders (especially due to coccidiosis, E. Coli, mycosis etc.) must be done. Constipation should be checked by giving adequate amount of fibre in the diet. Regular vaccination for IB, RD and Merek's as per schedule and deworming should be done to control the pathogen load in the bird.

Miscellaneous factors

Injury to the vent

The red appearance of the cloaca just after laying of egg attracts the pen mates towards vent pecking which causes injury to the oviduct and may predispose to prolapse in future laying cycles[15, 41]. Further the exposed rectal organ can also get injured by the nesting materials leading to irritation in the reproductive tract which may again lead to prolapse vent.

Laying of double yolked eggs

The excessive size of these eggs will stretch and possibly weaken cloacal muscles[40]. Weakened cloacal muscles will lead to an increase in the amount of time the oviduct is outside the body. If the flock is laying more than 4% double-yolked eggs, 5-10% feed restriction may be advised.

Poor weight uniformity

Flock with either over or under target weighed birds are more prone to prolapsed[16]. The common causes for non-uniformity in body weight includes crowding, too much competition for feed and water, improper debeaking with respect to time and method, difference in light intensity which may lead impaired temperature regulation in the shed, ammonia accumulation inside the shed due to improper ventilation, improper grinding of feed, faulty chick placement after hatch and various

disease conditions mainly respiratory diseases, coccidiosis, gubmoro etc. So proper measures along with careful supervision to eliminate the above mentioned factors is of utmost importance. Along with these, proper feed restriction for proper monitoring of the weight should be done.

Shank length

Pullets with ideal weight but shorter shank length are more prone to prolapse vent, mostly due to excess abdominal fat accumulation[22]. The objective should be to restrict feed for proper monitoring of body condition so as to minimize the fat accumulation in the abdomen.

Prevention

In order to prevent prolapse in poultry, the following summarized measures can be proved fruitful to reduce the incidences[15, 17, 40].

- As always, careful and vigilant management will lower the rate of prolapse occurrence as well as most other flock health problems.
- Isolate affected birds to prevent further damage
- Photo stimulation should occur when the birds reach the weight and age recommended by the breeder.
- Balanced feed rations are required to sustain egg production and maintain body weight at recommended levels.
- Provision of adequate light as per the need of the birds.
- If the flock is laying more than 4% double-yolked eggs, 5-10% feed restriction of intake should be done.
- Spend time with birds to observe vent-pecking behaviour, and isolate them from the flock.
- A very low wattage red-color bulb in the pen. If birds cannot distinguish the colour of the everted shell gland in the red back ground.

Treatment

There is no specific treatment for prolapse. Still there are some effective ways to treat the prolapse hen[15, 17]. The first step is to remove the hen from the flock to prevent cannibalization. Reduce the hens feed (or even don't feed her for one day) to interrupt laying. This will give the birds much needed break in laying. The main constiuents in feed formulations which help to prevent prolapsed are energy, protein levels together with calcium and phosphorus levels.

Effective herbal care:

The protruding organ is washed in lukewarm water and using a natural oil (linseed oil or sweet oil), gently press the vent back into the body. Repeat several times as needed. Then wipe the vent area with a cloth or cotton ball that has been soaked in witch hazel (*Hamamelis*virginiana).Witch hazel is an astringent and anti-inflammatory that tightens skin, soothes and reduces swelling. It is used, among other things, to relieve the pain of hemorrhoids and bruises[15, 17].

Effective non-herbal care:

Wash the protruding organ in lukewarm water and using petroleum jelly, gently press the vent back into the body. Repeat several times as needed. Then treat the vent area with a combination of Preparation H and antibiotic ointment. Preparation-H reduces the swelling tissue and allows the tissue to recede[15]. Restoration of peripheral 17â-estradiol concentrations to normal levels plays an important role in recovery of prolapse[28]. In the event of a severe prolapse (if you truly do not wish to cull the bird), a purse suture to the cloaca may be needed.

CONCLUSION

Good feeding, management, timely vaccination and preventive measures against certain diseases play the most important role in preventing conditions of prolapse. It is the best birds which are the victims of this complex problem. It is more often a managemental problem rather than a genetic problem. Careful and vigilant managerial skills can protect the birds from this. The light and feeding schedule is to de dealt properly and timely to get the best possible results.

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