Trends in developmental anomalies in contemporary broiler chickens – part 1

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For many years the broiler industry has focused on genetic selection for rapid gain of muscle mass, decreased time from hatch to market, and increased feed efficiency. This strategy has resulted in a chicken genotype with superior growth characteristics.

However, in association with the successful development of economically important targets, some undesirable traits have become apparent. In many ways, experience from the work on genetic improvement of broilers has provided a unique insight into understanding the effects of 'human controlled evolution' on overall health.

Variety of health problems

Over the 60+ years' history of intensive selection, the broiler industry has witnessed a variety of health problems involving muscular, digestive, cardiovascular, integumentary, skeletal, and immune systems. Many debilitating diseases marring modern broiler production are well documented, but this represents only one aspect of the health problems.

Recently completed sections of our long term study revealed trends in the incidence of anatomical anomalies in contemporary broilers.

The occurrence of embryonic abnormalities signifies a discreet category of health problems, and careful monitoring of congenital anomalies provides very valuable information regarding the overall health status of the population.

Nevertheless, with the exception of a handful of incidental reports, the research on embryonic anomalies in broilers has been dormant during the last several decades.

Moreover, there is a dearth of epidemiological information on naturally occurring anomalies in modern commercial broilers.

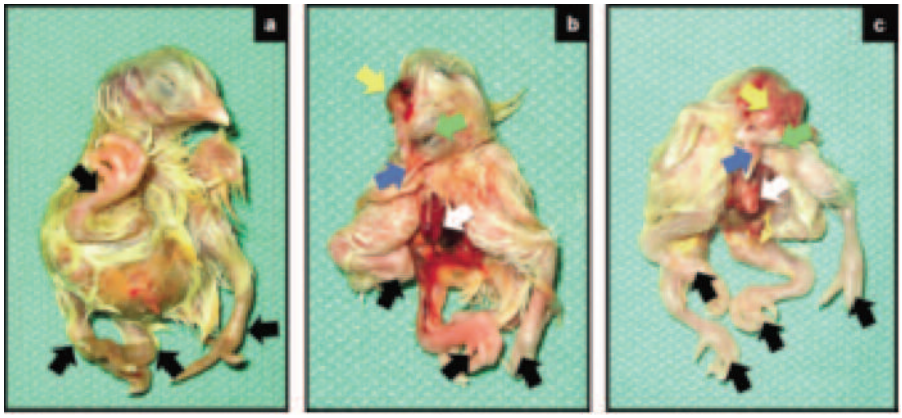

Fig. 2. Monstrosities primarily affecting the trunk of the body presented as sole leg deformity, or multiple monstrosities involving legs, cranium, beak, and viscera. Fig. 2a shows a near term embryo with four legs (arrow). This monstrosity is not necessarily lethal, and some chicks with this anomaly may hatch successfully. In many instances, embryos with leg deformities (Figs. 2b and c, black arrows) also showed multiple anomalies including exposed brain (yellow arrows), eyes anomalies (green arrows), beak deformities (blue arrows) and exposed internal organs due to failure of abdominal closure (Figs. 2b and c, white arrows). Monstrosities shown in Figs. 2b and c are lethal.

Therefore, a research project was developed to examine both type and incidence of anatomical anomalies occurring in commercial broilers. The study was conducted at the University of Saskatchewan, Canada in collaboration with Lilydale Wynyard Hatchery, Sofina Foods Company.

Extensive data

The data gathering activities commenced in 2003 and included examination of eggs that failed to hatch, newly hatched chicks, and monitoring of commercial flocks for the occurrence of anatomical anomalies. The

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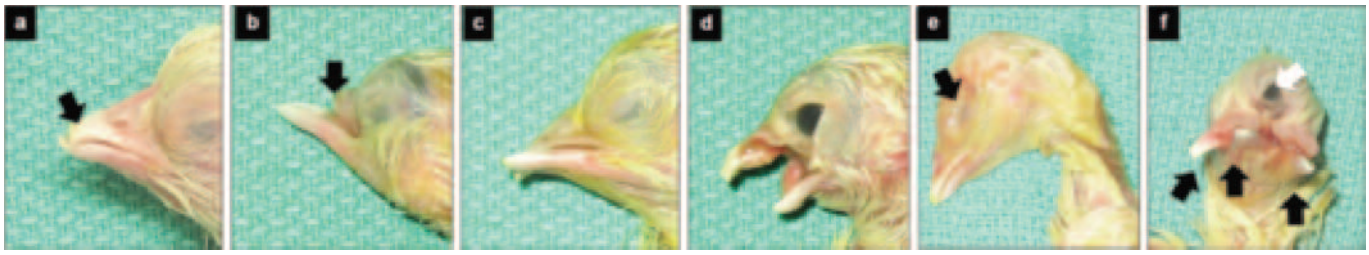
Fig. 1. Monstrosities involving various combinations of beak and eye anomalies.



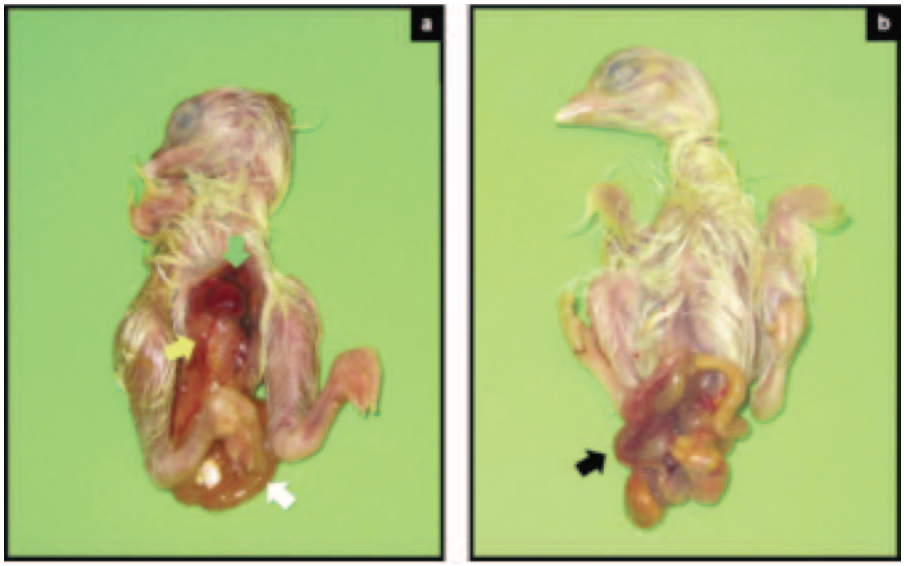


Fig. 3. Exposed viscera in 18-20 day old broiler chicken embryos. The landmark of this embryonic pathology includes exposed viscera due to failure to close coelomic cavity as presented in Fig. 3a, where failure to close coelomic cavity resulted in total exposure of internal organs including heart (green arrow), liver (yellow arrow), and gastrointestinal tract (white arrow). In addition to this, we also observed many cases with partially incomplete closure of abdominal wall as presented in Fig. 3b (arrow).

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study is ongoing, and we plan to continue this activity into the foreseeable future.

During the course of our research, we documented practically all types of monstrosities reported previously in avian species.

However, we also documented several embryonic defects that were previously not observed in broilers.

All common anomalies were observed in all strains of broilers used for commercial purposes in the province of Saskatchewan. Among the more common deformities observed in our study were anomalies involving beak and eyes (Fig. 1).

Beak anomalies

Common beak anomalies included underdeveloped upper beak (Fig. 1a, arrow), lack of upper beak (Fig. 1b, arrow) and cross beak (Fig. 1c). Occasionally, deformity characterised by growth of soft tissue inside of the mouth (Fig. 1d) was observed.

Common anomalies of eyes included lack of eyes (anopthalmia) shown in Fig. 1e (arrow), and single eye (cyclopia) shown in Fig. 1f (white arrow). Noteworthy are multiple monstrosities in Fig. 1f showing in addition to cyclopia, multiple beaks (black arrows).

Various malformations of limbs and trunk were also a common finding. Anomalies of both wings and legs were observed, but in the majority of cases deformities were predominantly confined to legs.

The affected embryos showed grossly disfigured legs (mostly at joint levels) and frequently presented extra members or multiple sets of legs, but more typically limb deformities occurred together with several other anomalies (Fig. 2).

Very common deformities encountered in our study can generally be characterised as protrusion of the viscera through an open abdominal wall in otherwise normally developing embryo (Fig. 3).

Classical celosomia

In the older literature, the monstrosity shown in Fig. 3a was described as celosomia attributed to the underdeveloped sternal crest and caudo-lateral processes, associated with autosomal recessive gene.

In the present study, we observed many cases consistent with the classical form of celosomia where all internal organs (heart, liver, and entire gastrointestinal tract) are exposed.

However, we also noted another anomaly characterised by partial incomplete closure of the abdominal wall where only some segments of intestines were exposed (Fig. 3b, black arrow). In many cases, the intestines are incarcerated by the closing abdominal muscle, which resulted in severe congestion and necrosis.

This form of anatomical anomaly has not been reported previously in commercial broilers, and was described in detail only recently (Wojnarowicz and Olkowski, Avian Pathology, 2009, 38:509-512). Since our first report, the incidence of this anomaly has shown increasing trends. ■

Part 2 of this article on 'Trends in developmental anomalies in contemporary broiler chickens' will be featured in the next issue of International Hatchery Practice.