

Avian Leukosis

Avian leukosis (AL) includes a variety of transmissible benign and malignant neoplasms of chickens caused by vertically transmitted immunosuppressive avian leukosis virus (ALV), members of the *Alpharetrovirus* genus of the family *Retroviridae*. ALV is classified antigenically into 6 envelope subgroups, A, B, C, D, E and J. AL has a significant economic importance due to mortality and reduced productivity.

Etiology:

Avian leukosis virus (ALV) is an enveloped RNA *Alpharetrovirus* of family *Retroviridae* characterized by the presence of enzyme reverse transcriptase necessary for the formation of a DNA provirus that is integrated in the host genome during virus replication. Avian retroviruses are sensitive to fat solvents and detergents. The virus inactivated by 37°C for 100-540 minutes, 50°C for 8.5 minutes and 60°C for 0.7 minutes. ALV is classified antigenically into 6 envelope subgroups, A, B, C, D, E and J. The virus is propagated in day-old susceptible chicks by intra-abdominal or intra-muscular routes, 11-day old chicken embryos by intra-venous route and chicken embryo fibroblasts. ALV induces tumors by two main types of mechanisms: **(1)** by the activation of a cellular proto-oncogene after ALV integration. This leads to the activation of cellular oncogenes and resulting in neoplastic transformation. **(2)** By the activation of a transduced oncogene carried by the ALV genome. Such viruses are able to induce tumors rapidly and are termed “acutely transforming” viruses.

Transmission:

ALV is transmitted either by vertical (congenital or egg) or by horizontal spread through contact. According transmitted naturally, the virus can be classified as exogenous or endogenous. Exogenous leukosis viruses spread as infectious virions, either vertically (congenitally) from dam to progeny through the egg or horizontally from bird to bird by contact. Viruses of subgroups A, B, C, D and J spread in this way. Endogenous leukosis viruses (subgroup E) are transmitted genetically in a Mendelian fashion by both sexes to their progeny

Genetic resistance:

Two types of genetic resistance to the ALV group are recognized: resistance to virus infection and resistance to tumor development.

Hosts:

Chickens are the natural hosts for all viruses of ALV. Turkeys are susceptible to ALV-J.

Signs:

Depression, emaciation, loss of weight, persistent low mortality and reduced production pattern, enlargement of abdomen are the most common detectable clinical signs. However, many birds show no clinical signs. Vaccination failure may be observed in some cases due to the immunosuppressive effect of ALV.

The signs in chickens affected by leukosis are nonspecific. The bird may be inappetent, weak and emaciated, diarrhea may occur and the wattles may be pale. Low growth rate and egg production.

Disease forms:

1. Lymphoid leukosis: Big liver disease, lymphatic leukosis, visceral lymphoma, lymphocytoma, lymphomatosis, visceral lymphomatosis.
2. Erythroblastosis: Leukemia, intravascular lymphoid leukosis, erythroleukosis, erythromyelosis, erythroid leukosis.
3. Myeloblastosis: Leukemic myeloid leukosis, leukomyelosis, myelomatosis, granuloblastosis, myeloid leukosis.
4. Myelocytomatosis: Myelocytoma, aleukemic myeloid leukosis, leukochloroma.
5. Endothelial tumors: Hemangioma, angiosarcoma, endothelioma, mesothelioma.
6. Osteopetrosis: Marble bone, thick leg disease, sporadic diffuse osteoporostitis.

Necropsy:

AL serotype J: Liver enlargement, often with tumor foci, splenomegaly and enlarged kidneys also occur. The most characteristically are chalky white tumors in the bone marrow, particularly of the

sternum, ribs, sacral joint. Microscopic tumors usually contain well-differentiated myelocytes. Two cell types may be found in the same tumor.

Lymphoid Leukosis: It occurs in chickens aging 4 months and older. Tumors involve the liver, spleen and bursa. Other organs often involve as kidney, lung, gonads, heart, bone marrow and mesentery. The tumors are soft, smooth and glistening; a cut surface appears grayish to creamy white. Tumor's growth may be nodular, military, diffuse or combination of them.

Erythroblastosis: It occurs in chickens aging 3-6 months. The liver and kidney are moderately swollen and spleen is greatly enlarged. The enlarged organs are usually cherry red to dark mahogany and are soft and friable. Bone marrow is hyperplastic, semi-liquid and red in color. Petechial hemorrhages occur in various organs as muscles, subcutis and viscera.

Myeloblastosis: Natural cases are uncommon and usually occur in adult chickens. Liver is greatly enlarged and firm with diffuse grayish tumor infiltrates, which give a mottled or granular appearance (Morocco Leather). Spleen and kidney could be involved. Bone marrow is replaced by a solid, yellowish-gray tumor cell infiltration. Severe leukemia is observed with myeloblasts comprising up to 75% of peripheral blood cells and forming a thick buffy coat.

Osteopetrosis: The lesions appear in long bones such as shank and bones of the pelvis, shoulder girdle and ribs. The lesions are usually bilateral symmetric. The periosteum is thickened and the abnormal bone is spongy. The severity of the lesions varies from slight exostosis to massive asymmetric enlargement with almost complete obliteration of the bone marrow cavity.

DIAGNOSIS

1. Signs and lesions
2. Histopathological examination of tissues from infected birds to identify the neoplasm type.
3. Virus isolation/detection: Viruses can be detected in and isolated from serum, plasma, buffy coat cells, tumor tissue, normal parenchymatous tissues (e.g., liver), feather pulp and tips, vaginal and cloacal swabs, egg albumen and embryos. Because the viruses are thermolabile at room temperature, samples should be collected from live or freshly killed

birds, or from newly laid eggs, and stored and shipped at -70 °C. ELISA is available commercially for the detection of ALV antigen in various materials. The antigen ELISA is also used to detect ALV growth in virus isolation tests in CEF.

Virus characterization

The subgroup of ALV isolates may be determined by several methods:

- **Viral interference assays**, which test the ability of an ALV isolate to prevent focus formation in C/E CEF cultures by RSV strains of known subgroup (RIF- test). Virus neutralization assays, in which the isolate, or the RSV pseudo-type of the isolate, is exposed to antisera with known neutralization specificity to each subgroup, and examined for growth, or focus formation; respectively.
- Polymerase chain reaction (PCR) primer pairs are available specific for the different ALV subgroups.
- Serology: Virus neutralization tests, in which antibody is detected by ability to neutralize infectivity of ALVs, or RSV pseudo-types, of known subgroup; these tests are technically demanding and time consuming. ELISA test for antibodies to subgroups A, B and J are available commercially. The complement fixation test for ALV (COFAL).

Prevention and Control:

Because no treatment or vaccines are available for AL, one should obtain birds from an ALV-free strain or from genetically resistant stock.