Circoviridae

Chicken Anaemia Virus

Circo = circular ssDNA viruses

The smallest known animal viruses

Circoviridae

Chicken Anaemia Virus

Group II: ssDNA viruses

Family: Circoviridae
Genus: **Gyrovirus**
Circovirus

Chicken anemia virus (CAV) has a world-wide distribution.

Infection of young chickens causes **anemia, decreased weight gain, transient immunosuppression**, and **increased mortality**.

Infection of chickens older than 3 or 4 weeks of age usually does not cause clinical signs, but can cause **immunosuppression** resulting in secondary infections or can result in economic losses even in the absence of evidence of any disease.

Circoviridae

Chicken Anaemia Virus

Chicken anemia virus causes an acute, immunosuppressive disease of young chickens, characterized by anorexia, lethargy, depression, **anaemia**, **atrophy or hypoplasia of lymphoid organs**, **cutaneous, subcutaneous**, and **intramuscular hemorrhages**, and increased mortality.

Disease occurs in chicks hatched to asymptomatically infected breeder hens that have been infected before egg laying. Typically, **chickens of 2–4 weeks of age are infected** and develop anemia with hematocrit values ranging from **60% to 27%.**

Mortality rate: 10–20%, and the surviving chickens recover from anemia by 20–28 days post infection.

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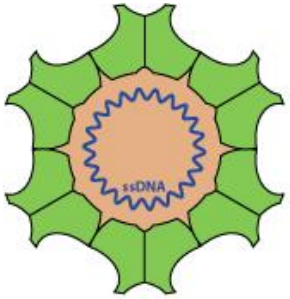
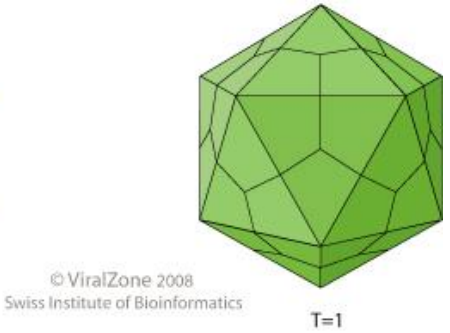
Chicken Anaemia Virus

Non-enveloped, round,
Icosahedral symmetry, about 20 nm in diameter.
The capsid consists of 12 pentagonal trumpet-shaped pentamers.

GENOME

Monopartite, circular, **ssDNA genome** of about 1.8 to 3.8 kb.
The genome is replicated through double-stranded intermediates.
The replication (Rep) protein initiates rolling circle replication.





REPLICATION: NUCLEAR
NATURAL HOSTS Birds and mammals.

TROPISM CAV:
Chicken: **Thymocytes, erythrobalstoid cells**
Egg: embryonal tissues and eggshell membranes

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Physical Properties:

The virus is extremely resistant to disinfectants and can resist heat treatment at 80°C for 15 minutes. Due to its ubiquitous presence in chicken flocks, its small size, and its resistance to physical and chemical treatments

Epidemiology:

Chicken anemia virus associated disease **was first recognized in Japan in 1979**, although it is not a new agent and had probably been present in chickens for many years.

Infection occurs **worldwide** in all countries with industrial poultry industries.

Host: The virus is not known to **infect birds** other than chickens, and only a single serotype has been recognized, although some (low level) genetic variation has been reported among virus isolates both within and between countries.

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Chicken Anaemia Virus

Pathogenesis

The **natural route of chicken anemia virus transmission is oral**, **and feces from infected chickens are the main source of virus for horizontal transmission** among chickens.

Chicken anemia virus can also be **transmitted vertically through hatching eggs**. Vertical transmission occurs for a period of 3–9 weeks after chicken anemia virus infection.

When 1-day-old susceptible chicks are inoculated with chicken anemia virus, **viremia occurs within 24 hours** and virus can be recovered from most organs and rectal contents for up to 35 days.

Thymic and bone marrow atrophy, and less commonly **bursal atrophy**, are characteristic gross lesions in infected birds.

In chicken anemia virus-infected chickens with severe anemia, hemorrhagic-aplastic anemia syndrome as characterized by intracutaneous, subcutaneous, and intramuscular hemorrhages can also occur.

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Chicken Anaemia Virus

Pathogenesis

When day-old susceptible chicks are inoculated IM with CAV, viremia occurs within 24 hours. Virus can be recovered from most organs and rectal contents as long as 35 days after inoculation. **The principal sites of CAV replication are hemocytoblasts in the bone marrow, precursor T cells in the cortex of the thymus, and dividing CD4 and CD8 T cells in the spleen**.

Replication in and **destruction of the hemocytoblasts leads to anemia**, whereas replication in and **destruction of the T cells causes immunosuppression**.

Neutralizing antibodies are detectable 21 days after infection, and clinical, hematologic, and pathologic parameters return to normal ~35 days after infection.

Chicken anemia virus infection has adverse effects on proliferative responses of spleen lymphocytes and on the production of interleukin-2 and interferons by splenocytes. Infection can cause a **marked decrease in generation of antigen-specific cytotoxic T cells and T-helper cells directed against other pathogens**.

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Clinical signs :

anemia (PCV ≤27)
paleness
anorexia
lethargy
depression
watery and slowly clotting blood
reduced weight gain
high mortality rates resulting from secondary complicating infections (generally 10%–20%, but as much as 60%)

Anaemia, leukopenia, and pancytopenia seen often on blood smears

Blue wing

Gangrenous dermatitis of the skin under the wings of a bird infected by chicken anemia virus.

Organs are pale; the **thymus is generally atrophied**, and the bursa of Fabricius may be small. Bone marrow is pale or yellow. **Hemorrhages may be present in or under the skin and in muscle and other organs**.

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Diagnosis:

1. Reduced hematocrit and PCR for detection of CAV nucleic acids in blood lymphocytes

2. Viral isolation: Chicken lymphoblastoid cell lines are available, some of which can become resistant to CAV infection with cell passage. Furthermore, these cell lines grow in suspension, so the cytopathic effect of CAV infection is difficult to recognize.

To isolate CAV, chloroform-treated extracts of tissues are inoculated in **MDCC-MSB1 or MDCC-147 cultures** (both are lymphoblastoid cell lines derived from Marek's disease tumors) or into maternal antibody–negative day-old chicks. The presence of CAV DNA or proteins in the culture or chicken tissues must then be verified by PCR or antibody assays (e, immunohistochemistry or immunofluorescence).

3. PCR
4. Immunohistochemistry
5. ELISA

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Immunity

Immunity to chicken anemia virus is complex. Neutralizing antibodies are protective against disease, but **do not completely protect chickens against infection** or result in virus clearance. The presence of antibodies in breeders greatly reduces vertical as well as horizontal transmission. Several commercial vaccines are available and are mainly used in broiler breeders.

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Live Chicken Infectious Anemia Virus vaccine, **Del Ros strain**, for use in chickens using wing **web administration**. Stored at 35 - 45°F (2 - 7°C).

INDICATIONS
CIAV is recommended for the active immunization of chickens against Chicken Anemia Virus.

ADMINISTRATION AND DOSAGE

Use only by **wing web administration** to healthy, susceptible chickens **9 to 12 weeks** of age.
Wing Web: Insert the applicator into the webbed portion of the wing avoiding feathers, muscle, bone and blood vessels (0.01 ml dose/bird). Vaccine should be used within one hour.

PACKAGED
10 X 1,000 dose vials and wing web applicators

THANKS

AB's Veterinary Microbiology

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