

**PSITTACINE BEAK AND FEATHER DISEASE**

| Animal Group(s) Affected                            | Transmission   | Clinical Signs   | Severity  | Treatment   | Prevention and Control  | Zoonotic   |
|---|--|--|---|---|---|------------|
| Psittacines - Old World more than New World species | <p>Direct contact with infected animals with virus presented by inhalation or ingestion.</p> <p>Indirect contact with contaminated excretions, secretions and feather dust.</p> <p>Virus remains in contaminated environments, particularly air handling systems, for years.</p> | <p><u>Peracute:</u><br/>Particularly common in African grey parrots with pancytopenia and death.</p> <p><u>Acute:</u><br/>Depression followed by appearance of dystrophic feathers and death.</p> <p><u>Chronic:</u><br/>Progressive appearance of dystrophic feathers. Necrotic beak and ulcerations in some long term infected birds. Death occurs in months to years.</p> | <p>Aggressive disease most common in African grey, vasa, and ecleetus parrots, and cockatoos.</p> <p>PCV-1 associated disease is fatal in most Old World psittacines.</p> <p>Chronic and less severe disease in lovebirds, lorries and lorikeets, particularly those birds infected with PCV-2.</p> | Supportive care should be provided in isolated environments where even caretakers have no contact with other birds. | <p><u>Prevention</u><br/>PCR-based testing has reduced spread in managed populations.</p> <p>Developed vaccine has reached governmental approval stage.</p> <p><u>Control</u><br/>Testing and isolation of infected birds; strict entry quarantine protocols.</p> | None known |

**Fact Sheet compiled by:** Branson W. Ritchie

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**Fact Sheet Reviewed by:** Thomas N. Tully; Lauren V. Powers

**Susceptible animal groups:** All psittacines are susceptible to infection. Most New World species develop a rapid immune response and clear the virus, although classic disease has been documented in some New World species (i.e., macaws and Amazon parrots). Classic disease associated with PCV-1 can occur in any Old World psittacine but is most common in cockatoos, African grey parrots, ring-necked parakeets and ecleetus parrots. PCV-2 causes less severe disease and affected birds may recover from disease; infections with this pathotype are most common in lorries and lorikeets. Lovebirds may be infected with PCV-1 alone or with both PCV-1 and PCV-2. Disease progression appears to vary in lovebirds infected with both pathotypes.

**Causative organism:** Psittacine circovirus - a non-enveloped icosahedral DNA virus belonging to the family *Circoviridae*. Two pathotypes, PCV-1 and PCV-2 must be distinguished for accurate prognosis and patient management. Circovirus infections have also been documented in Anseriformes, Columbiformes, Passeriformes, Galliformes and gulls.

**Zoonotic potential:** No known human transmission has occurred.

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**Distribution:** Virus likely evolved in Australia and has been disseminated globally through transcontinental movement of infected birds. Virus could be found on any continent with a sufficient population of free-ranging or captive psittacine birds to support virus survival and transmission. Virus will continue to spread in untested or, until available, unvaccinated psittacine birds.

**Incubation period:** Experimentally, signs appear in 3-4 weeks. However, variation in disease progression can make the incubation period appear longer.

**Clinical signs:** Most birds infected with PCV-1 develop a transient infection that can be detected by finding viral DNA in whole blood. Most infected birds subsequently respond with an appropriate immune response and clear the virus with no recognizable clinical changes. In unmanaged (untested) populations, infection should be considered relatively common while disease is comparatively uncommon.

**Peracute/Acute Form:** These forms most commonly occur in young chicks, and may begin with signs unrelated to the beak or feathers. Affected birds are often depressed and regurgitate due to crop stasis. They may develop a diarrhea-causing enteritis, or pneumonia, and die without displaying any lesions of the feathers or beak. This peracute form of the disease is particularly common in African grey parrots that frequently die with acute hepatic necrosis. In the acute form, feather abnormalities in already developed feathers (from causes other than PCV) should be distinguished from abnormalities associated with the developing feather (from the pulp cap to the feather base). Visible developmental feather abnormalities include: retention of the feather sheath, hemorrhage of the pulp cavity, shortened deformed feathers and circumferential constrictions at the feather base. Stress lines are common in affected feathers. Affected feathers are often loose, break easily, may bleed, and elicit a pain response with minimal manipulation. Some chicks die within days to weeks of the first signs of feather abnormalities and others survive with progression to chronic disease.

**Chronic Form:** Newly developing powder down and contour feathers are the first to show clinical changes in birds that exhibit feather abnormalities after their remiges and rectrices are developed. The visible changes in these feathers are similar to those described above. In psittacines other than lovebirds, feather lesions associated with PCV-1 become progressively worse with each successive molt and if the bird survives for years it may become mostly or completely featherless as feather follicle damage prevents replacement.

In some affected birds, beak abnormalities may occur that typically start as a brownish necrotic area on the inside of rhinotheca. Affected beaks may elongate, becoming progressively deformed, and fracture. Secondary beak and oral infections are common in necrotic areas of the beak. Some affected birds may develop beak elongation in the absence of necrosis. In some birds, the nails can also be deformed or slough.

Birds with the chronic form of the disease may live for months to years. Progressive disease is associated with organopathies that are likely associated with immune suppression and birds usually die from secondary bacterial, fungal, parasitic, or other viral infections.

Birds with PBFD shed substantial quantities of extremely environmentally stable virus in their feather dander and should not be maintained in environments (aviaries or hospitals) or by care takers that have direct or indirect contact with other birds. Recovery of Old World psittacines with the chronic disease associated with PCV-1 has not been documented. Comparatively, PCV-2 appears clinically less virulent and lorries and lorikeets with moderate feather abnormalities have been shown to recover as indicated by a return to normal feather plumage and no detectable viral DNA in their blood. The PCV-2 pathotype has only been documented as a monotypic infection in lorries and lorikeets. Comparatively, other psittacines, particularly lovebirds, have been documented with both PCV-1 and PCV-2 and the role that co-infection may play in altering the virulence of PCV-1 and thus the progression of classic disease is unknown.

**Post mortem, gross, or histologic findings:** Gross feather and, less often beak, changes described above are associated with the circovirus infection. In chronic cases, other lesions related to the secondary infections that actually lead to the birds death will be found at necropsy.

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Predominant histological lesions include necrosis and ballooning degeneration of epithelial cells in the epidermal collar and epidermal, basal and intermediate zones of the developing feather shaft. The follicular epithelium also may be necrotic, but this lesion is reported less commonly. Feather sheath hyperkeratosis prevents the feather from ex-sheathing resulting in retention of the feather sheath. Feather pulp lesions are characterized by suppurative inflammation, including perivascular accumulations of heterophils, plasma cells, macrophages and rarely lymphocytes. The characteristic basophilic intracytoplasmic - and less commonly intranuclear - inclusions are usually, but not always present in diseased feathers. Granulomatous dermatitis with vesicle formation was described in a group of infected lovebirds.

Histologic lesions in the beak of PBF/D birds are similar to those described in their feathers, including necrosis and hyperplasia of epithelial cells in the basal and intermediate epithelial layers. Hyperkeratosis and separation of the cornified outer layer from the underlying tissues and bone may also be evident, and are often accompanied by secondary necrosis and osteitis of associated tissues

In peracute cases, histologic lesions may be limited to severe bursal or thymic necrosis with the presence of viral inclusion bodies. Feather pathology in these cases may not occur, or may be limited to edema in the follicular epithelium (if present).

In birds with beak disease, necrosis and inflammation of the epithelial lining of the tongue, beak cavity, and crop have also been reported. Secondary Gram-negative bacteria and fungi are commonly isolated from beak lesions and may be associated with acute or chronic inflammatory reactions.

**Diagnosis:** PBF/D should be considered in any bird presenting abnormal feather loss or developmental abnormalities. PBF/D can only be diagnosed by detection of the virus using *in situ* hybridization, immunohistochemistry or electron microscopy to document the virus or viral components in diseased tissues. For antemortem diagnosis, a biopsy of 3-4 diseased feathers and their associated follicle is recommended. It is critical for the clinician to biopsy diseased feathers. Both diseased and normal feathers can be present directly next to each other and failure to obtain a biopsy of diseased feathers can result in an inaccurate diagnosis. Birds with the peracute and early acute forms of the disease may die before the development of feather abnormalities and disease is documented by histopathologic evaluation of internal organs including the bursa, thymus and liver.

PCR-based testing can be used to detect target segments of viral DNA in the blood of suspect birds before feather abnormalities develop but this condition does not confirm the presence of disease. Most birds infected with PCV develop a transient infection that can be detected by finding viral DNA in whole blood. Most infected birds subsequently respond with an appropriate immune response and clear the virus with no recognizable clinical changes. A bird that is PCR positive for PCV-1 and does not have dystrophic feathers must be retested in 90 days to determine if the bird has cleared the virus. It is important that birds be maintained in a virus free environment during this 90 day period. The author has placed vaccinated (protected) birds in the same room with PBF/D positive birds and viral DNA can be intermittently detected in the vaccinated birds because of persistent environmental exposure to the virus and the subsequent clearing of the virus through the blood that is necessary for any inhaled or ingested virus.

A bird that is PCR positive for PCV-2 and does not have dystrophic feathers must be retested in 180 days to determine if the bird has cleared the virus. Lories with PCV-2 and with dystrophic feathers have been documented to recover from disease but should be maintained in strict isolation during any convalescent period. Virus is being shed in the dystrophic feathers until they are replaced even though viral DNA can no longer be detected in the blood.

For the most current recommendations on testing and interpretation of PCR-based assays, see [www.vet.uga.edu/SAMS/IDL](http://www.vet.uga.edu/SAMS/IDL).

**Material required for laboratory analysis:** Biopsy of dystrophic feathers and their associated follicle in formalin for histologic diagnosis. Whole blood collected by venipuncture. Blood samples collected by toe nail

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clipping should be considered environmental samples and not a bird specific sample. Feathers submitted for PCR-based testing should also be considered environmental samples and are not bird specific. Viral DNA can be detected by PCR-based testing in environmental swabs. These can be used to document the extent of environmental contamination (air filters, fan motors, nest boxes, etc.) and for evaluating cleaning efforts following an outbreak.

Post-mortem samples include bursa, thymus, liver, spleen, kidney, and dystrophic feathers (if present) in formalin. Swabs of tissues collected from the cut surface of the bursa, thymus or liver can be used for rapid detection of viral DNA. Only disposable scalpel blades should be used for collecting post-mortem samples or swab may be positive because of transfer to the cut surface of the organ from viral contaminated instruments. Prior to shipping, blood samples should be stored refrigerated (4°C/39.2°F). Samples must be shipped in a padded envelope or box. In cooler seasons, samples may be sent by regular mail, but overnight is recommended. For the most current recommendations on sample submission, see [www.vet.uga.edu/SAMS/IDL](http://www.vet.uga.edu/SAMS/IDL).

### **Relevant diagnostic laboratories:**

Infectious Disease Laboratory  
College of Veterinary Medicine  
University of Georgia  
110 Riverbend Rd  
Riverbend North, Room 150  
Athens, GA 30602-7390  
706 542-8092  
Fax: 706 583-0843  
[www.vet.uga.edu/SAMS/idl/](http://www.vet.uga.edu/SAMS/idl/)

**Treatment:** No known specific antiviral treatment.

**Prevention and control:** Transmission of the virus is primarily through inhalation or ingestion of air or food containing viral contaminated feather or fecal dust. Contaminated clothing, hair and body surfaces of care takers can also serve to disseminate the virus as can contaminated bird carriers, feeding utensils, nest boxes and nesting materials. Two of the most severe modern (post PCR-based testing) outbreaks the author investigated were associated with use of a contaminated grinder for nail grooming and the sale of a contaminated egg incubator. Maternal transmission has been documented. The virus is extremely environmentally stable and for the safety of birds any contaminated environment should always be considered a source of infectious virus. Any diseased birds should be maintained in strict isolation and the care takers of these birds should always be considered contaminated with the virus. Maintain strict quarantine and testing protocols for new birds prior to entering the collection.

PCR-based testing should be used during entry quarantine to detect viral DNA in the blood. See the recommendations above for testing procedures and interpretation. Because of the difficulty in decontaminating a typical clinic, it is not recommended that known diseased birds be evaluated or maintained in the hospital. PCR-based testing of environmental swabs can be used to document the severity of viral contamination in the environment.

A PCV vaccine has been developed by the Emerging Diseases Research Group at the University of Georgia and the vaccine awaits a USDA approved manufacturer to take the necessary steps to register the vaccine for commercial use.

**Suggested disinfectant for housing facilities:** While specific data on the susceptibility of PCV to disinfectants is unknown, it is known that other circovirus are among the most environmentally stable and disinfectant resistant of all viruses. The goal in a contaminated facility is to wash the virus out of the environment, expose contaminated surfaces to prolong drying and direct sunlight and then seal any remaining virus to a substrate

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with paint (or equivalent). Any contaminated surface that is porous (not made of metal or plastic) should be discarded. All metal, concrete and plastic surfaces should be washed with a sodium hypochlorite (e.g. Clorox)-containing detergent, rinsed and allowed to dry in direct sunlight. The procedure should be repeated 3-4 times. Air handling systems should be professionally cleaned by a company experienced with decontaminating hospital air systems. Once repeated cleaning has been accomplished, a pressure painter should be used to coat all remaining surfaces (floor, walls and ceiling). If a diseased bird has been maintained in an incubator, one should make certain that the fan and motor housing are decontaminated and PCR negative for viral DNA before the fan is returned to service. PCR-based testing can be used to evaluate the success for virus removal from the environment.

**Notification:** Not needed.

**Measures required under the Animal Disease Surveillance Plan:** Not applicable

**Measures required for introducing animals to infected animal:** It is not recommended to mix infected and non-infected birds.

**Conditions for restoring disease-free status after an outbreak:** Remove any birds with feather dystrophy and maintain in isolation while conducting additional diagnostic testing. Remove birds without feather dystrophy from any potentially contaminated environment, wash the birds if feasible and wait 90 days (one could also blood test these birds for the presence of viral DNA immediately but many will be blood positive and clear the virus. Waiting 90 days with the birds in a non-contaminated environment will reduce the number of birds that require additional testing). Follow the current testing recommendations based on the detected pathotype provided at [www.vet.uga.edu/SAMS/IDL](http://www.vet.uga.edu/SAMS/IDL). PCR-based testing of environmental samples collected during and after the cleaning and decontaminated process as detailed above.

**Experts who may be consulted:**

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