Retrospective study of PDD (Proventricular Dilatation Disease) incidence in Psittacine birds from Barcelona Zoo

Anna Moya Clivillé
Facultat de Veterinària, Universitat Autònoma de Barcelona

I. INTRODUCTION AND OBJECTIVES

Proventricular Dilatation Disease (PDD) is a fatal infectious syndrome that affects mainly Psittacine birds and is spread around the world. Its incidence has increased in the last few years and the disease has been reported to occur in more than 80 species. Although PDD was long suspected to be a viral disease based on epidemiologic observations and the typical lesions, it was not until 2008 that was first identified the presence of a novel *Bornavirus* in infected birds, which was named *Avian Bornavirus* (ABV). ABV has since been considered the etiologic agent of this disease.

The aim of this review is to explain the basic concepts of the disease including its epidemiology, pathology and treatment. Furthermore, an insight of PDD diagnosis and the under development techniques will be included. Once established this basis, the PDD incidence in Psittacine birds from Barcelona Zoo will be described, based in the necropsy and biopsy samples analysed by Veterinary Pathology Diagnosis Service (SDPV) from Autonomous University of Barcelona (UAB).

II. EPIDEMIOLOGY AND PATHOLOGY

PDD was initially reported in captive Psittacine birds and then spread worldwide favoured by intensive trading. Its transmission has not yet been clarified and many studies have proposed different infection routes, including fecal-oral and urinary route and others such as respiratory or vertical transmission.

The name of the disease describes the predominant feature: a dilatation of the proventriculus caused by the effect of ABV in the enteric nervous system that elicit a lymphoplasmacytic inflammatory infiltrate which interrupts the normal nervous signal.

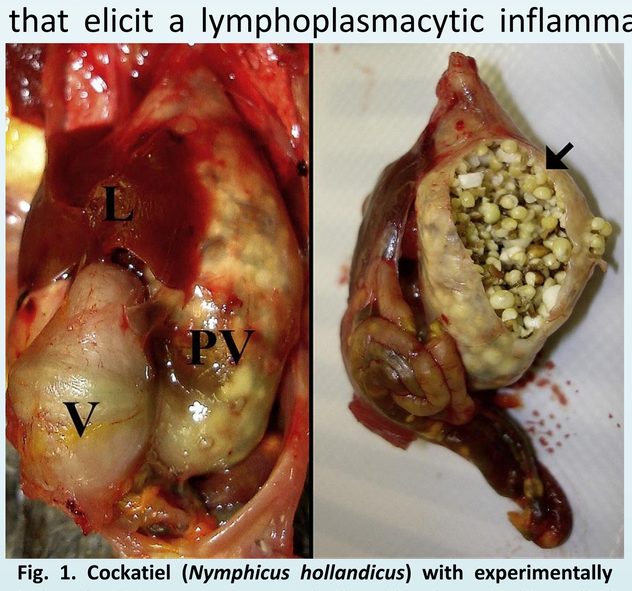

Fig. 1. Cockatiel (*Nymphicus hollandicus*) with experimentally induced PDD necropsy: Markedly dilated and thin-walled proventriculus (PV) with severe impaction with seeds (arrow). L, Liver; V, Ventriculus (Source: Gancz *et al,* 2010).

This intestinal dysfunction and altered motility leads to gastrointestinal signs. It has also been reported neurological signs such as ataxia, tremors or seizures.

As PDD lacks of an effective treatment, anti-inflammatory prolonged therapy supported by an aided digestion and a secondary infections control is usually applied. Therefore, the prognosis is poor.

There is neither vaccine nor preventive official protocol.

III. DIAGNOSIS

Apart from laboratorial changes and clinical signs, imaging diagnosis provides a first non-definitive diagnosis. Survey radiography shows the typical proventriculus and ventriculus dilatation. Contrast radiography and fluoroscopy also provides information about transit time and peristalsis

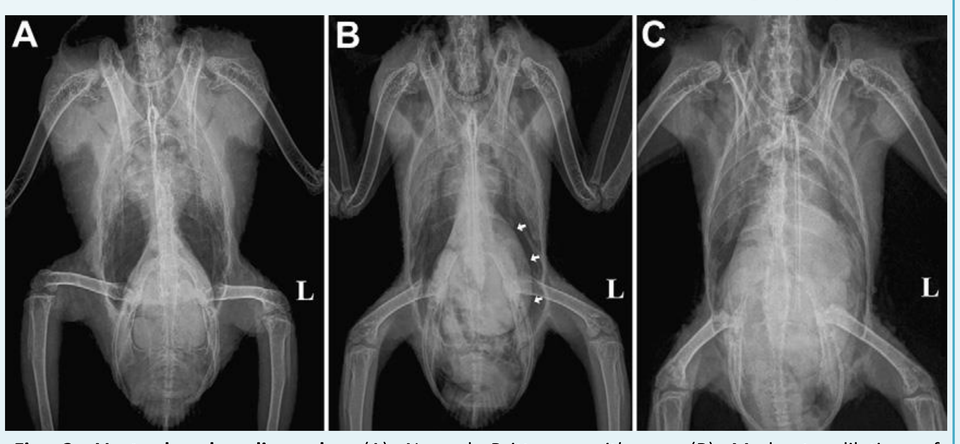

Fig. 2. Ventrodorsal radiographs: (A) Normal *Psittacus erithacus*. (B) Moderate dilation of proventriculus (arrows) in a *Psittacus erithacus* with PDD. (C) Severe dilation of the proventriculus and ventriculus in a *Cacatua sulphurea* with PDD (Source: Gancz *et al,* 2010).

The gold standard diagnosis for PDD is probably histological examination with presence of characteristic lesions such as lymphoplasmacytic inflammatory infiltrate within enteric nervous system. A complementary technique is immunohistochemical staining, which detects ABV antigens.

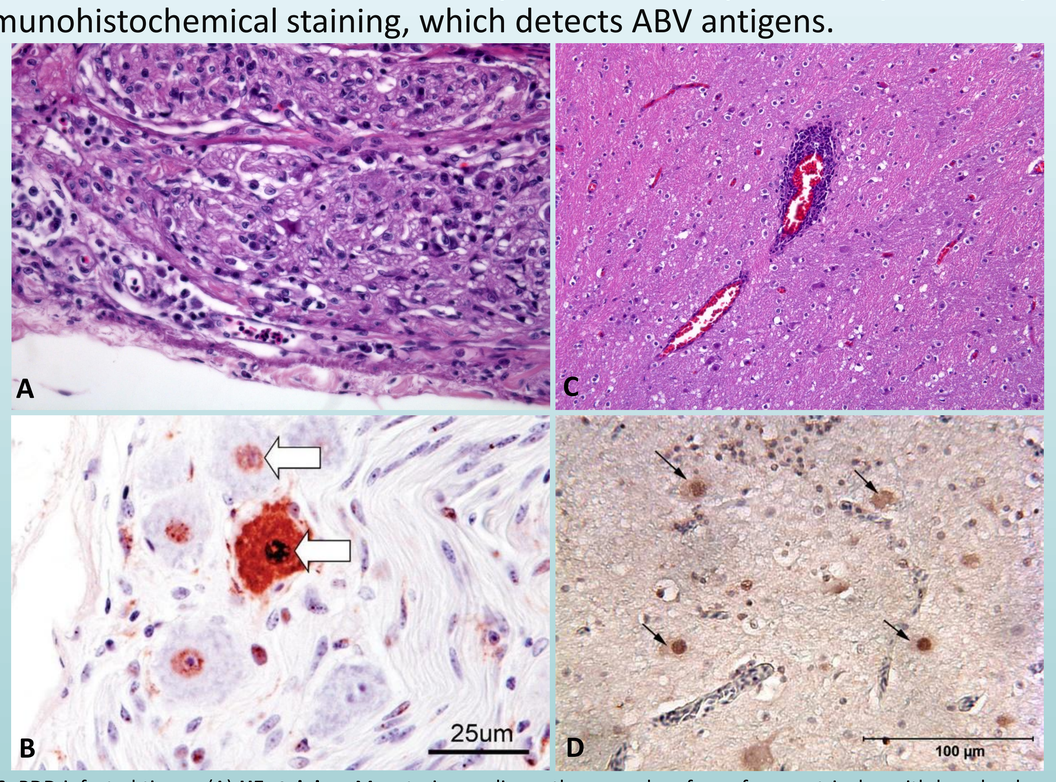

Fig 3-6. PDD infected tissue. (A) **HE staining:** Myenteric ganglia on the serosal surface of proventriculus with lymphoplasmacytic inflammatory infiltrate (Source: SDPV). (B) **Immunohistochemical staining for Avian Bornavirus (ABV) antigen:** Myenteric ganglia on the serosal surface of proventriculus with intranuclear staining in the neurons (Source: Raghav *et al,* 2010). (C) **HE staining:** Cerebrum tissue with perivascular cuffing by lymphoplasmacytic inflammatory infiltrate (Source: SDPV). (D) **Immunoperoxidase-staining cerebrum for Avian Bornavirus (ABV) antigen:** Cerebral tissue, nuclei more heavily stained than cytoplasm (Source: Ouyang *et al,* 2009).

Reverse transcriptase RT-PCR also provides a useful diagnosis but its sensitivity is uncertain. Under development techniques which might be helpful in the future are serological screenings.

IV. DIAGNET REVIEW (1999-2014)

The SDPV received 20 samples from Barcelona Zoo, mainly from *Aratinga* (65%) and *Amazona* (20%) genus. Presence of lymphoplasmacytic inflammatory infiltrate could be seen in different organs in all of them, especially in the gastrointestinal tract.

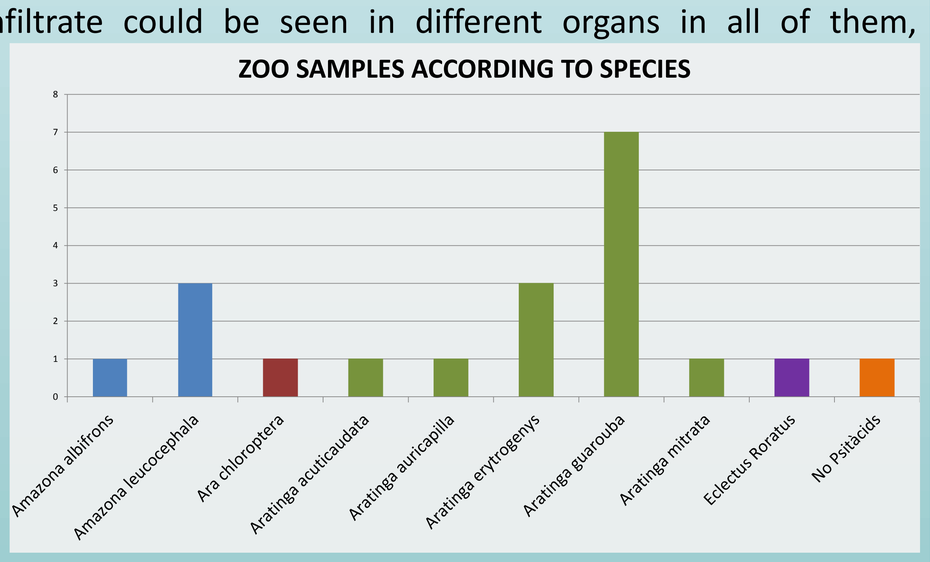

Fig. 7. Barcelona Zoo samples analysed by SDPV (1999-2014) distribution according to species (X axis, species; Y axis, number of samples).

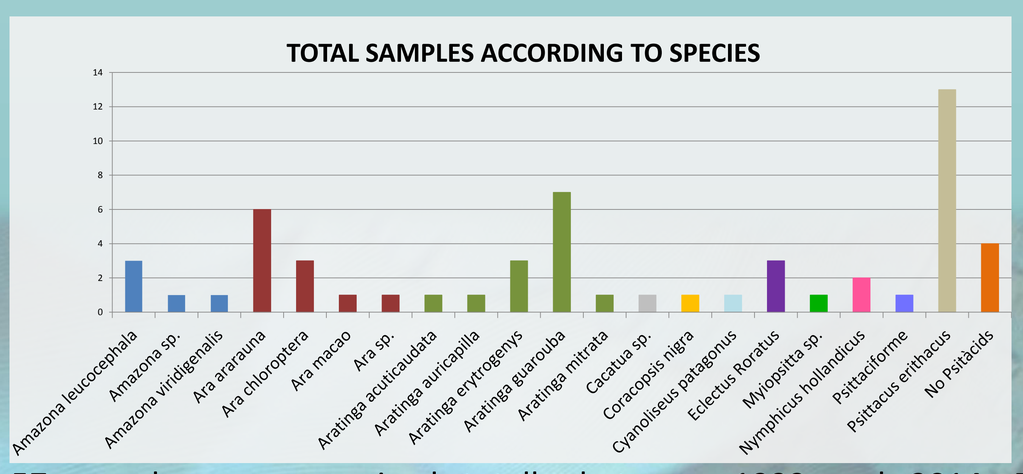

Fig. 8. Samples analysed by SDPV (1999-2014) distribution according to species (X axis, species; Y axis, number of samples).

57 samples were received totally between 1999 and 2014. The most predominant were *Psittacus Erithacus* (24,6%) and birds from *Ara* (19,3%) and *Aratinga* (22,8%) genus. Every animal had its enteric nervous system affected.

V. CONCLUSIONS AND REFERENCES

I. PDD is being expanded to many species and places, and ignoring the pathology complicates its management, treatment and prevention.
II. More investigation about the pathology should be made.
III. Development of a definitive diagnosis technique would be needed.
IV. Barcelona Zoo should make an exhaustive screening to know PDD status.

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