CHLAMYDIAE AND ATHEROSCLEROSIS: CAN PSITTACINE CASES SUPPORT THE LINK?

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Atherosclerosis is a slow and progressive disease that usually affects the large and medium sized arteries. As a result of thickening of the artery wall, the diameter of the lumen decreases and the blood flow is reduced. In severe cases, ischemia in the area receiving blood from the artery occurs. Atherosclerosis is a common disease in birds, especially in orders such as Anseriformes (swan, geese, duck), Columbiformes (pigeons, doves) and Psittaciformes (parrots, parakeets). Risk factors predisposing birds to atherosclerosis is unknown, but since the lesions in birds closely resemble those in man, risk factors in humans may extend to birds. The intention of our retrospective study was to detect chlamydiae in formalin-fixed atherosclerotic tissue from birds, in order to clarify their role in atherosclerosis.

Chlamydiae are unique intracellular pathogens with a biphasic developmental cycle consisting of the infectious elementary body (EB) and the non-infectious reticulate body (RB). Chlamydiae cause a variety of diseases in different animal species including humans, birds, koalas, cats, pigs, cattle, sheep and goats.

Chlamydia pneumoniae was first described in humans in 1986. It is a common cause of upper respiratory tract infections and accounts for up to 10% of community-acquired pneumonia. Recently it has been associated with several chronic diseases such as Alzheimer’s disease and atherosclerosis. The first report that discussed a possible connection between Chlamydia pneumoniae and atherosclerosis was a serologic study performed in Finland in 1988. Seropidemiologic studies were followed by studies in which the organism was identified in atherosclerotic tissue by electron microscopy, immunocytochemical staining and PCR. However, the results of those studies are inconsistently reporting a large variability in detection rates. Therefore the real prevalence of Chlamydia pneumoniae within atherosclerotic lesions and its role in atherogenesis is still a matter of controversial debate in human medicine.

Atherosclerosis in birds - mainly in parrots - seems to be more prevalent and severe than in any species of mammals, except for men. Postmortem findings in birds examined between 1991 and 1997 revealed an incidence for atherosclerosis of 7% for the psittacines, whereas only 0.6% of the passerines showed this disease. Of the atherosclerotic psittacines, 79% were parrots, with the highest incidences for the African grey parrot (35%) and the amazons (22%). In contrast to man, little is known about risk factors of atherosclerosis in birds. Age, genetics, plasma cholesterol levels, diet, inactivity, social stress and obesity were discussed in parrots.

Chlamydia pneumoniae has yet never been found in birds. In a recent study from Sudler et al., all fifty-one chlamydal isolates from birds collected in Switzerland were classified as Chlamydia psittaci. On the other hand Chlamydia psittaci is widespread in avian populations, where it causes disease with varying morbidity and mortality.

In the present study, researchers investigated the presence of chlamydiae in vascular tissues from 103 pet birds with atherosclerosis. The birds consisted mainly of parrots (89.3%) with the highest incidences for African grey parrots and amazons, as described in other reports. Atherosclerosis was often an ancillary finding. However atherosclerosis was the only disorder found in the majority of cases classified as grade 4 (severe). Histologic classification revealed no association between age of the birds and degree of atherosclerosis (Fig. 1). This is in contrast to a study showing that severity of atherosclerosis in parrots increased with age. However, in this study, smaller parrots with lower expectation of life – like cockatiels and lovebirds - with severe atherosclerosis were also investigated. On the other hand, none of the macaws that can reach high ages, showed severe atherosclerosis.

Only 4 of 103 birds – two amazons, one budgerigar and one jacana – were positive in the PCR. With online BLAST searches, a high similarity to Cp. psittaci for the two amazons and the jacana was found. No further identification was possible with the budgerigar sample. Immunohistochemistry was not to our satisfaction. None of the 9 IHC-positive sections could be confirmed by repeated PCR run. Furthermore, sections from the 4 PCR positive cases were negative in IHC. Poor correlation between PCR and IHC in atherosclerotic tissue has been reported in other studies. Interestingly, the two amazons sequenced positive for Chlamydia psittaci came from Chlamydia-infected populations and have been tested for Chlamydia antigen at post mortem.

An etiological role of Chlamydiae can’t be confirmed by our study. If Chlamydiae cause atherosclerosis in birds, their presence would be expected to precede that of disease. One hypothesis states Chlamydiae to act as focal point in atherosclerosis. After initiation of the disease, they disappear from the lesions. In this case, one would expect to find Chlamydiae with a higher prevalence in slight atherosclerotic lesions rather than in the severe ones. Furthermore, it is still possible that after initiating the disease process, the organism has disappeared and thus is not detectable when atherosclerosis develops. However experimental infections with different Chlamydia psittaci strains in birds showed, that no signs of atherosclerosis were found at necropsy, even 210 days post infection. In another hypothesis, Chlamydiae initiate atherosclerosis and persist in vascular tissue. Thus their prevalence would be similar in every grade of atherosclerosis. If Chlamydiae play no role in atherosclerosis, but prefer the altered vascular tissue as a favourable environment for persistence or growth, one would expect to detect them mainly in lesions of grade 3 or 4. In this study, Chlamydiae were only found in older lesions (grade 3 or grade 4), suggesting no role for them as initiators of atherosclerosis.

In conclusion, researchers could detect Chlamydiae in atherosclerotic tissue from 4 of 103 birds. The low incidence (3.9%), the occurrence only in advanced stages of atherosclerosis and the association with Chlamydia psittaci-infected avian populations, leads to the conclusion that there is probably no association between Chlamydiae and atherosclerosis in pet birds.

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