EXCESSIVE IRON STORAGE IN CAPTIVE BIRDS OF PARADISE AT AL WABRA WILDLIFE PRESERVATION

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Abstract

Birds of Paradise (BoP) are among the bird species considered susceptible to iron storage disease (ISD). Because ISD was diagnosed at histopathology in several BoP at the Al Wabra Wildlife Preservation, we conducted a retrospective evaluation of the necropsy reports available at this institution. Of 25 birds investigated for iron deposition in the liver, only two animals were considered negative for ISD. Apart from a diet of low-iron bird pellets and fruits, the animals received two mineral supplements that were not used for, but also contained, high levels of iron. The results confirm the high incidence of ISD in BoP; a discontinuation of the high-iron supplements was instigated.

Key words Birds of Paradise, iron storage disease, necropsy, diet, supplement

Introduction

Birds of Paradise (BoP) and bowerbirds have long attracted interest because of their display habits and exaggerated display plumes of adult males (Diamond, 1986). They are found in regions of Eastern Indonesia, New Guinea and North-eastern Australia. Their main food consists of fruit, seeds, and small insects.

At Al Wabra Wildlife Preservation (AWWP), six different species of BoP (*Cicinnurus magnificus, Cicinnurus regius, Seleucidis melanoleuca, Paradisaea minor, Paradisaea rubra, Paradisaea apoda*) and the Flame Bowerbird (*Sericulus aureus*) have been kept since 2000 and 2007. BoP are among the bird species reported to be susceptible to iron storage disease (ISD) in captivity (Dierenfeld et al., 1994).

In particular, we predicted that due to ISD being suspected to be a chronic process, adults should be affected with excessive iron storage more often than juveniles; additionally, we suspected that accidental deaths (traumatic injuries) should have a less frequent additional diagnosis of excessive iron storage than animals for which an organic or systemic disease was diagnosed as the cause of death.

Materials and methods

Records for 40 birds that died between 2000 and 2006 were available for this evaluation. BoP that had died at AWWP had been submitted to gross pathological examination on site by a veterinary pathologist, and samples had been taken for histological examination at different laboratories (in the United Arabian Emirates or in Germany). The findings of the necropsy reports were entered into an EXCEL datasheet and evaluated according to their frequency. In cases where more than one finding related to the supected cause of death was stated by the pathologists, both diagnoses were included in the total count. In the data set, excessive iron storage was diagnosed based on the presence of iron pigments - in the liver, and sometimes in the small intestines or other organs, after special staining. Additionally, the diet fed to the BoP at AWWP was recorded, and the feeding behaviour of the birds was observed, during two consecutive days.

Results

Of the 40 birds that died, 14 were juveniles (6 males, 3 females, 5 not identified) and 26 were adults (18 males, 8 females). The number of deaths varied between three and ten animals per year, with no discernible trend over the years. Similarly, no seasonal trend of mortality was evident when the number of deaths was evaluated by months.

The body condition of the birds was not consistently noted on the reports, with a more thorough documentation from 2002 onwards. Out of the 8 juveniles in which it was noted, only one animal was judged to be in a poor body condition. Out of the 19 adults in which it was noted, 8 birds were considered in poor body condition.

Among the pathological processes noted in the birds, there were 13 cases of nephropathy (mostly degenerative tubulonephrosis), 12 cases of traumatic incidents or accidents (including juveniles fallen out of/pushed out of the nest), 12 cases of respiratory disease (different forms of pneumonia), and 12 cases of severe parasite infestation (Capillaria in 4 cases, Raillietina in 4 cases). A contribution of bacterial infections was suspected in 8 cases (five of which *E. coli*). Degeneraton (vacuolation) of the adrenal gland was diagnosed in five cases. There were four cases each of blindness, of thyroid degeneration, and of a muscle degeneration indicative of vitamin E deficiency.

Excessive iron storage was first specifically investigated by special histological staining in 2002. Birds that died between 2000-2001 were not investigated for ISD. Additionally, many juvenile birds were not investigated for excessive iron storage even in subsequent years, often due to progressed autolysis when the carcass was found. Four out of 14 juveniles, and 19 out of 26 adults were investigated for iron deposits: all four juveniles were positive for excessive iron storage, and only 2 out of the investigated adult birds were negative. In the total dataset, therefore, only 2 tissue sets out of 23 that had been investigated for excessive iron deposition in liver (and sometimes other tissues) were negative. These two negative birds had both been considered to be in poor body condition.

When the different diagnoses were plotted, each together with the concomitant occurence of excessive iron storage, the suspected pattern seemed evident: the diagnosis "trauma/accident" was less frequently associated with excessive iron storage than the other diagnoses (***Fig. 1***). However, birds diagnosed with "trauma/accident" were investigated for excessive iron storage in only four cases, all of which were positive.

With respect to individual cases, it is noteworthy that excessive iron deposits were already noted in the youngest bird investigated (18 days old). This animal was also heavily infested with Raillietina tapeworms and was additionally diagnosed as appearing anaemic. Similarly, one adult bird (age three years) was diagnosed not only with ISD but also with an anaemic appearance. In both cases, no blood values to determine hematocrit or blood hemoglobin content had been available prior to death.

The diet fed to the BoP at AWWP consisted of two feeding per day of fresh fruits (papaya, pear, apple, mango, grapes, oranges, and banana), low-iron bird pellets- Ziegler Bird of Paradise® (Ziegler Bros, Inc., USA; 70ppm Fe) or Wittemolen Care Plus Granulates for Mynah® (Witte Molen BV, Meeuwen, The Netherlands; 56.6/kg Fe) and water. Observations during the feeding showed that the birds always consumed the pellets first, and completely. In contrast, the fruits were only partially consumed – in particular, the upper layers. At the surface of the fruits, two mineral/vitamin supplements were sprinkled - Nekton Tonic-F® (210mg Fe/kg as Fe-II-sulphate) and Nekton S® (3000mg Fe/kg as Fe-II-sulphate) (both Günter Enderle Nekton, Pforzheim, Germany).

Discussion

The results of this evaluation provide further evidence that excessive iron deposition in the liver can be observed in BoP. Hemosiderosis is a frequent finding in captive birds and often associated with a variety of other diseases not necessarily related to liver function (Cork et al., 1995), similar to the findings in this survey. The relevance of the finding of (massive) hemosiderosis in birds is still ambiguous, although it has lately been explicitly associated with liver pathology in mynah birds (Rossi et al., 2005). In particular, it is unclear whether the state

actually occurs in free-ranging animals as well. On the one hand, hepatocellular hemosiderosis was a prominent finding in one individual wild-caught BoP (Ensley and Osborn, 1993); on the other hand, two free-ranging BoP had drastically lower liver iron levels than captive specimens (Dierenfeld et al. , 1994). Differences in iron content between wild and captive diets have been suggested as one underlying cause and documented for toucans (Otten et al., 2001), but remain to be demonstrated in other species.

Inanition is one of the possible causes for increased iron deposition in liver tissue, as e.g. demonstrated in fasting birds (Borch-Iohnsen et al., 1991). However, the fact that most BoP diagnosed with excessive iron storage in this survey were in good body conditions rules out chronic inanition as the causative mechanism at least in this subset of animals.

Different studies have shown that the dietary (available) iron content is relevant for the development of liver iron accumulation in birds (Dorrestein et al., 1992; Crissey et al., 2000; Seibels et al., 2003; Olsen et al., 2006), and treatment protocols for ISD usually include a change to a low-iron food (Cornelissen et al., 1995; Drews et al., 2004). Therefore, a reduction in dietary iron appears to be a rational step given the current knowledge. As a first reaction to this evaluation, the feeding of the high-iron supplements was discontinued. Other dietary changes that could be envisioned include a reduction in the proportion of pelleted feeds, or the soaking of the pelleted beads in decaffeinated black tea prior to feeding.

Finally, a more quantitative approach to iron storage is recommended, using a system of double analysis per bird, with a quantitative histological evaluation performed in a consistent way by one laboratory (formalin samples) and an analysis of the iron content in liver tissue (frozen sample) by ashing.

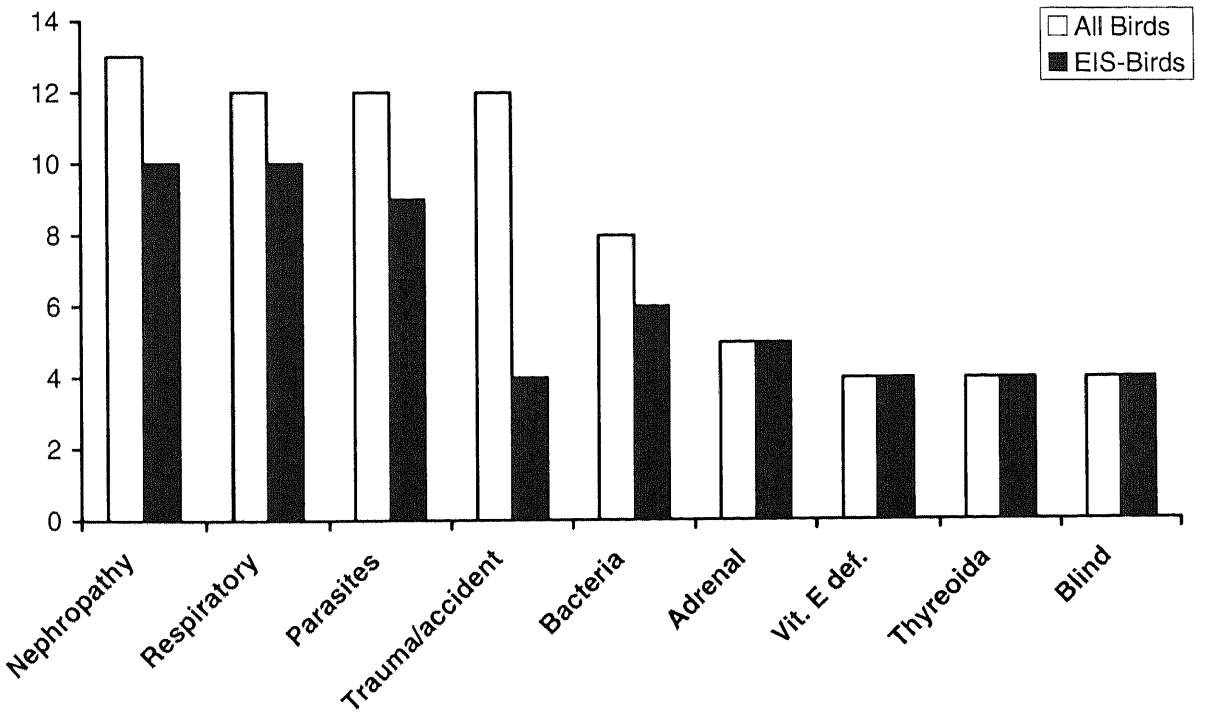

Figure 1. The association of excessive iron storage (EIS) and other pathological diagnoses in Birds of Paradise at AWWP. Note that not all birds were analysed for EIS; in particular, birds from the 'trauma/accident' category were rarely investigated in this respect due to advanced autolysis

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