

PROBLEMATIC INFECTIONS IN PARROTS – STREPTOCOCCAL AND ENTEROCOCCAL INFECTIONS, DIAGNOSTICS AND CONTROL

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ABSTRACT

Parrots are becoming more and more attractive pets in our country. Due to the cage nurturing and the stressful situations to that they are often exposed, the morbidity in these birds is relatively high. Our studies have shown that the some of the most common infections are streptococcal and enterococcal infections, The main methods of diagnosis of these diseases as well as the approaches for treatment and prophylaxis are presented.

Key words: parrots, infections, diagnostics, treatment, prophylaxis.

Introduction

Parrots are exotic birds, which are becoming more and more popular poultry pets and in our country. However, they have specific requirements for growing and feeding conditions that differ from species to species. Inadequate knowledge of their needs, poor and inadequate nutrition, insufficient care, as well as disruption of hygiene conditions, make them vulnerable to illness.

The most common infections in parrots are klebsiellosis, staphylococcosis, colibacteriosis and macrorhabdosis. Also, streptococcal and enterococcal infection are relatively common in these birds. They are caused by bacteria of the genera *Streptococcus* and *Enterococcus*, which also occur as a normal microflora on the skin and mucous membranes of domestic and wild parrots. They cause diseases under conditions of impaired immunity, also secondary infections in other bacterial, viral, fungal diseases and various toxicosis. Streptococcal and enterococcal infections often occur as a complication of aspergillosis, adenovirus infection, megabacteriosis, mycotoxin intoxications. Enterococci can cause acute septicemia or lead to the development of a chronic infection, always against a background of reduced immune protection (Mitchell and Tully, 2016).

The most commonly found pathogenic streptococcal species in the parrots are *S. pyogenes*, *S. pneumoniae* and *S. gallolyticus*. Streptococcal pathogenicity factors are endotoxins and exotoxins such as hemolysins, fibrinolysin, hyaluronidase, leucocidin and nucleases (Kaprelyan, 1986; Popova, 2016). Alpha hemolytic streptococci are most common in parrots as a normal microflora and as a causes of diseases. Beta hemolytic streptococci have the highest pathogenicity but from birds are isolated less frequently than from mammals. Gamma hemolytic are most types of the normal streptococcal flora and under normal conditions are not pathogenic (Kaprelyan, 1986; Popova, 2016).

In parrots, the most common pathogenic species of the genus *Enterococcus* are *E. faecalis*, *E. gallinarum*, *E. avium*, *E. faecium* and *E. durans*. Enterococci are distinguished by high resistance in the external environment. They show strong antibiotic resistance and the treatment of an infection

caused by these bacteria is mandatory after an in vitro test. Most species also occur as normal microflora in the parrot's intestines, but with immunosuppressive conditions they can cause bacteraemia and sepsis, as well as chronic infections, usually in the respiratory system.

Due to cage farming, breeding errors and stress situations, streptococcal and enterococcal infection are relatively common in parrots. Because of this, as well as due to the difficulties in their diagnostics and stable therapy, in the present work, we have set ourselves the goal of conducting research on the diagnosis of patients with such infections and on some approaches to treatment and prophylaxis.

Materials and methods

Patients. Among the significant number of parrots examined and treated by us with streptococcal and enterococcal infections, we selected seven typical cases characterizing all others with such diseases.

Anamnesis.

Patient 1 (P1). A male noble parrot (*Eclectus roratus*) Max two years old, in good overall condition, but about one month ago began to pluck the feathers of the neck, the flyers and the feathers of the abdomen. It is fed with bulk food from an unknown brand purchased from a pet shop. Supplements are not given to him. The owner has seen abrupt teaks, resembling lousing, as if the bird pursued outside parasites. She often has cuddled the bird and kissed her on the beak. Nothing in the bird's environment has changed in recent months, which could lead to possible stressful situations.

Patients 2 – Blue-forehead Amazon (*Amazona aestiva*), **3** – Blue-yellow ara (*Ara ararauna*) and **4** – *Pyrrhura molinae* showed similar signs.

Patients 5, 6 and 7 (P 5 – 7). Three small *Nymphicus hollandicus* parrots with normal health status up to about ten days of age, followed by clinical signs of denial of some meals a day, distortion of the legs and severe weight loss. The chickens are not manually fed, but are fed by both parents. Parents' ration consists mainly of millet, without the addition of vitamins, minerals and amino acids. Fruits and vegetables refuse to consume. Parents are young, this was their first hatch.

Microbiological studies. For isolation of microorganisms, cultures were made in elective and selective culture media for bacteria of different groups, as well as for fungi. They were cultured at 37 °C and 28 °C for 24 to 72 hours under aerobic conditions.

Nutrient media. Blood agar, agars of Mueller Hinton, Mac Conkey and Sabouraud with chloramphenicol (BUL BIO NCIPD Ltd. – Bulgaria), as well as Colorex orientation agar (HiMeida Laboratories Pvt. Ltd. Mumbai India, acquired by Ridadom-Sofia) were used.

Taxonomic identification of the isolated bacteria was performed by microscopic examination of Gram stained preparations, taking into account the cultural features and biochemical parameters by means of microtests ((HiMeida Laboratories Pvt. Ltd. Mumbai India, acquired by Ridadom-Sofia). The isolation and identification of the bacteria was performed in accordance with the Bergey's Manual of Determinative Bacteriology (Holt et al., 1994).

Determination of the sensitivity of isolated bacteria to antimicrobial means was carried out by the classic agar-gel diffusion method of Bauer et al. (1966). Standard antibiotic discs (BULBIO – NCIPD Ltd. – Sofia) were used after inoculation of bacterial suspension in exponential growth phase with a concentration of $2 \cdot 10^6$ cells/ml on Mueller Hinton agar. Incubation was performed at 37 °C

for 24 hours. The results were interpreted in a three-tier system of Bauer et al. (1966) after measuring the diameters of inhibitory zones in mm.

Results

Clinical examinations and tests.

P 1. During the inspection no deviations from the normal behavior were found. The bird occupies a normal defensive posture at provocation, stands on the highest perch and vocalizes with sounds common to the Eclectus parrot. Feathers on the chest, neck, abdominal air sacs, and the feathers are plucked and benten (Figure 1). The bottom of the cage is covered with faeces, ordinary in appearance, with no changes in the consistency of fecal matter, urates and the type and amount of urine. Internal body temperature was 41.2 °C, which is within the normal range. Dry wheezes are heard in auscultation of the chest and abdominal sacs. X-ray found out compaction on the walls of the air bags and blurring of their image on the picture. Complete blood count (CBC) did not show any deviations from the normal parameters. The biochemical urine test also showed no deviations from the norm.

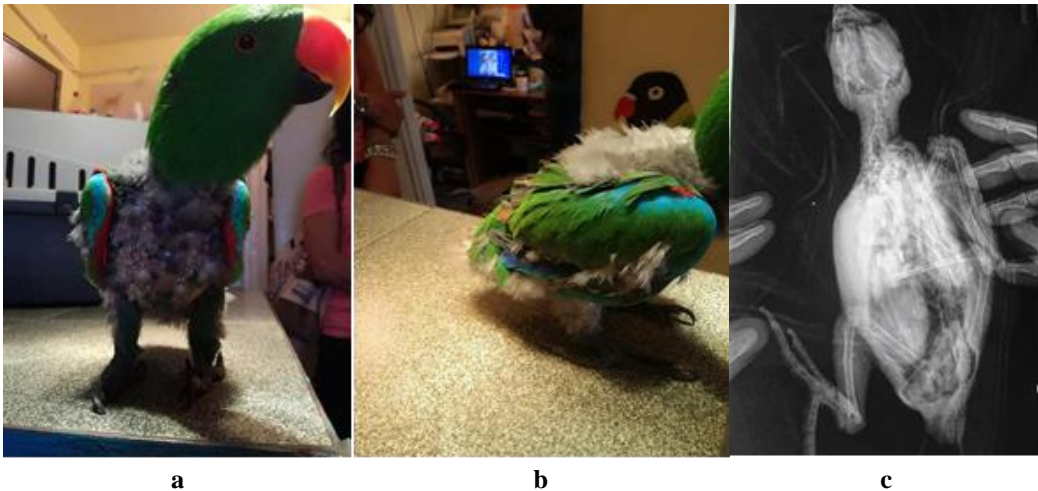


Figure 1: Max (P 1) at the examination - frontal view (a), side view (b) and X-ray photography (c).

Patients 2, 3 and 4. Similar studies were performed and the results were maximum close to that of P1.

P 5-7. The examination of the three parrots showed strong dehydration and weakness. Their plumage is poor, highly diluted, in places totally absent (Figure 2). The legs are heavily distorted, located at 180 degrees in "helicopter" position (Figure 2). In the hip joints areas, strong swellings are seen in the form of balls. Internal body temperature was set at 39.8 °C, 40.0 °C and 40.1 °C for the three birds, which is about one degree below the normal for the species and indicates the presence of infection. No pathological noises were detected in auscultation.

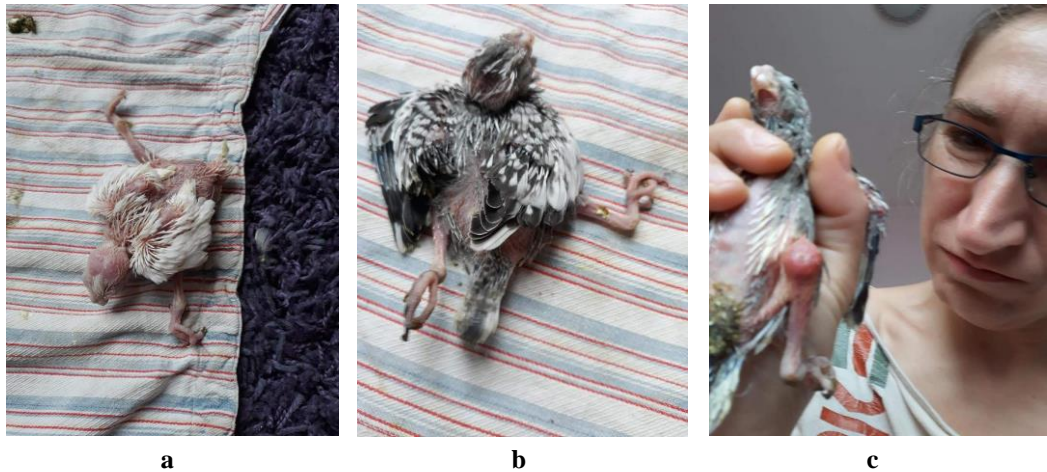


Figure 2: Parrots *Nymphicus hollandicus* in a "helicopter" position.

Microbiological studies.

P 1. The study of Gram stained microscopic faecal preparation showed a strong increase in microorganisms as a whole and a significant amount of Gram negative flora. Cultures on nutrient media were made from throat secretions, as well as and antibiotics sensitivity test, the results of which can be seen in Figure 3 b. *Enterococcus faecalis* was isolated (Fig. 3 c). The antibiotic tests showed the susceptibility of the agent to pradofloxacin, enrofloxacin, marbofloxacin, cotrimoxazole, doxycycline, moderate sensitivity to amoxicillin and tylosin insensitivity.

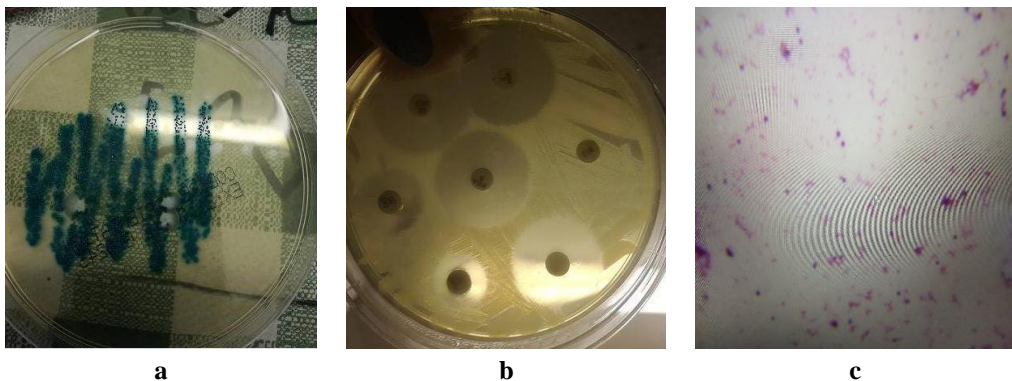


Figure 3: *Enterococcus faecalis* on Colorex orientation agar (a), antibiotics sensitivity test (b) and in slide by Gram, x 1000.

The microbiological studies of **P 2, 3 and 4** were similar. *Enterococcus faecalis* was isolated from all of them. The results of the antibioticgrams performed were also very similar to those of P1.

P 5-7. In a microscopic Gram stained slides of faeces, a predominant Gram-negative microflora and clostridia were found. Beta-hemolytic streptococci were isolated from the throat secretions, which were identified as *Streptococcus pyogenes* by biochemical tests. The antibioticgram showed sensitivity to amoxicillin / clavulanic acid, doxycycline, enrofloxacin, bisseptol, intermediate susceptibility to cefoperazone and marbofloxacin.

Diagnosis

P 1. As a result of the performed clinical and microbiological studies, the diagnosis Aerosaculitis chronica, Spnodilitis chronica and enterococcal infection with cause *Enterococcus faecalis* was put. The same diagnosis was also put on P 2, 3 and 4 (Figure 4).

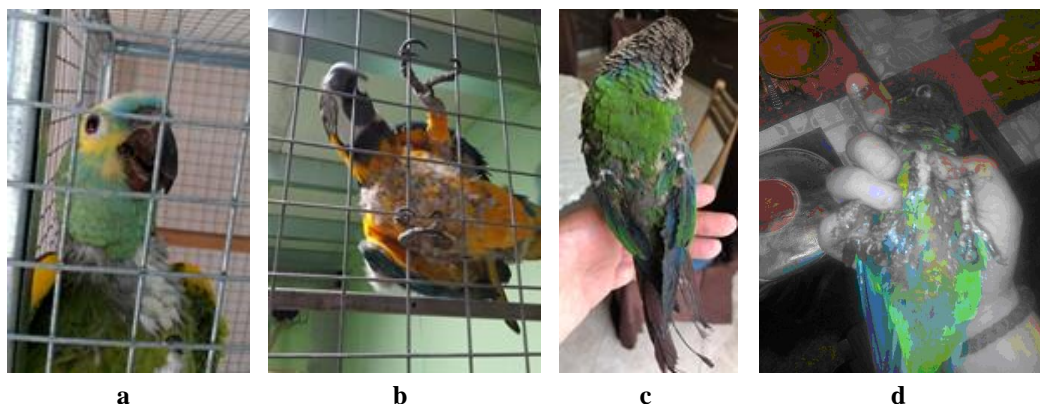


Figure 4: Patients with enterococcal infection: a – Blue-forehead Amazon (*Amazona aestiva*); b – Blue-yellow ara (*Ara ararauna*); (c) and d – *Pyrrhura molinae*.

P 5-7. As a result of the performed clinical and microbiological investigations, a diagnosis of Osteitis osis femoris et osis tibiotarsis and streptococcal infection with cause *Streptococcus pyogenes* was put.

Treatment

P 1. The bird was given Pradofloxacin treatment at a dose of 15 mg / kg bw. once daily (Verflox 0,25ml) for 20 days, also Meloxicam (Meloxydil) 0.5 mg / kg twice daily for ten days, nutritional supplements for feathering Nekton biotin three times a week for two months, probiotic PT-12 *Lactobacillus salivarius* three times a week for three months, and Imunoflash immunostimulator three times a week for three months. Control tests of throat secretions were designed and performed twice with an interval of 20 days, which proved to be free of pathogenic flora. This successful therapy was also applied to **P 2, 3 and 4**, resulting in complete clinical cure. Control microbiological studies, carried out one month after the end of treatment, were negative for pathogenic microflora.

P 5-7. Three patients were treated with Augmentin (amoxicillin / clavulonic acid) orally at a dose of 100 mg / kg body weight. twice a day. Transition to manual feeding with Nekton baby bird mash with a probiotic three times a day 2-4 ml was prescribed. Elastic buss were placed on their legs to straighten them. As a result of this complex therapy in two of the parrots, a significant improvement was achieved (Figure 5 a), although without complete straightening of the feet, but the third one required euthanasia.

Prophylaxis

P 1. A changing of the bird's diet and replacement with Roudybush granules for parrots and a seed-egg mixture containing the Extra Vital Immunostimulator was assigned. The owners were forbidden to kiss the bird on the beak. Excellent results and complete healing of the bird were achieved (Figure 5 b). The same prophylactic approach was successfully applied to the other three birds with enterococcal infection (**P 2, 3 and 4**).

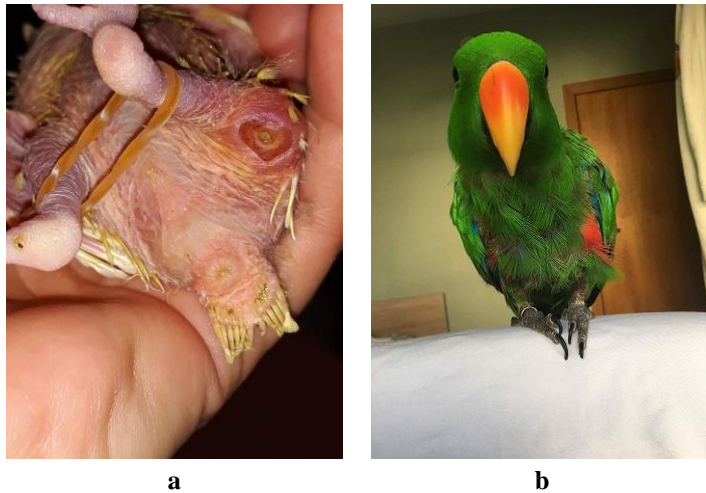


Figure 5: Significant improvement after an elastic bus and treatment of one of the parrots *Nymphicus hollandicus* (a); P 1 Max after three months (b).

P 5-7. The nutrition of the parenting couples is very important for the offspring to be vital and healthy. Previous food was replaced with Versele laga Parrot Prestige and supplemented with Vitamins Nekton S three times a week.

Discussion

The results of these studies are consistent with those of other authors such as Mitchell and Tully (2016). Enterococci can cause acute septicemia or lead to the development of chronic infection, always against a background of reduced immune protection. Usually, the younger females ill acute. The heart is most commonly affected with development of endocarditis. Also arthritis of the cervical vertebral joints develops with clinical signs similar to those described above. In some parrots also dermatitis is observed in the skin areas above the affected joints. Such birds usually suffer from self-plucking the feathers. When the case history is taken, it is understood that the hosts often kiss the bird or it feeds from their mouth. Leukocytosis and eosinophilia are observed.

The pathological anatomy finding often is non-specific. External examination of the corpse may reveal sinusitis, conjunctivitis, otitis with expulsions. If the disease is protracted, there is cachexia and bare skin areas of self-plucking. When the body is opened, endocarditis and polyserositis, usually in the air sacs, are observed. The lungs are swollen. The spleen may be enlarged, the liver also and has a greenish color. At enterococcal infections it may also have necrotic sites. Often the chronic flowing leads to peritonitis, salpingitis and oophoritis. Meningitis, esophagitis and haemorrhagiae are observed in the brain. Hemorrhages are observed also on the epicardium and endocardium, and in subacute or chronic flowing, there may be expansions similar to cauliflower, consisting of fibrin, macrophages and fibroblasts. The lining of the intestine is hyperemic, swollen and easily detached. The kidneys are enlarged in size and brittle. The joints are swollen and in the chronic form - filled with mucoid exudate (Kozlitan, 2017).

Our data shows that predisposing factors are of great importance for the nascence of disease in both types of infections we investigate. These are incorrect nutrition for the species, avitaminosis

A, bad zoo hygienic conditions, feuding between the birds of a flock with unceasing conflicts between them. Diseases can occur in acute or chronic form. Transmission of the infection occurs by air and aerosol way, with food or oral feeding and kissing between birds. It is possible through impaired skin and mucosal integrity, as well as transovarially. In the trans-ovarian transmission, the embryo usually perishes in late stages of development, or the chickens are very exhausted and can not break through the shell and die. If they can still leave the egg, they usually die of weakness in the first few days as they refuse to feed or are killed by their parents.

Infiltrating the blood of the infected bird, streptococci causes septicemia with thrombosis, embolism, and sudden death. The infection can also be protracted with damage to the internal organs, joints and bones or skin. Most often lung, air sacs and kidneys are affected. The sick parrots stand bristling, eyes closed. Polyuria and polydipsia are observed. Internal body temperature decreases to 38.5–39.0 °C. Feeding stops and the birds fall into hypoglycemia, which further aggravates the general condition. Breathing is difficult and cyanosis of the beak and legs frequent are observed, as well as swelling of the sinuses. This form usually ends lethally for 24–48 hours. Chronic illness runs slower. In young birds, the joints of the cervical and thoracic vertebrae are often affected. There may be an irregular shape of the neck and whole the body, the wings are lowered low down. Parrots experience severe pain. Such animals often shake and make movement as if something bites them. There is difficulty breathing, remitting diarrhea, weight loss. The course of this form of illness may last from a few days to several weeks, if no action is taken, it usually ends lethally.

The exact diagnosis is based on a microbiological study, demonstrating pathogenic streptococci or enterococci in throat secretion, internal organs, blood assisted by the autopsy find, or polymerase chain reaction (PCR). The diagnosed can not be put only based on the clinical signs because the illnesses we are studying resemble most bacterial and viral infections and often develop against the background of any of them.

The treatment of streptococcal and enterococcal infections begins with shock doses of antibiotics after an antibioticogram. It is indispensable for infections caused by the genus *Enterococcus* due to strong antibiotic resistance of field strains. In case of affection of bones and joints from enterococci, antibiotic therapy should last for several months without interruption. At the same time, it is necessary to create optimal feeding and viewing conditions. Probiotics and vitamin-mineral supplements are added in the portion.

Prevention of these diseases consists in creating optimal conditions of breeding and feeding, which are tailored to the requirements of each species of parrots. When the infection is detected, the patients are isolated and treated, the premises are emptied and thorough disinfection is carried out. In the poultry houses is being watched to prevent overpopulation, and regular change of contaminated food and water (Mitchell and Tully, 2016).

Conclusion

Predisposing factors such as poor zoo-hygienic conditions, poor nutrition for the relevant parrot species, avitaminosis A, enmities and conflicts between birds from one flock are of great importance for the occurrence and development of streptococcal or enterococcal infection.

Microbiological tests are essential for accurate diagnosis of streptococcal or enterococcal infection in parrots.

Because of the predominant antibiotic polyresistance of pathogenic streptococci and enterococci, antibiotic therapy must be performed obviously after *in vitro* test for sensitivity.

Pradofloxacin at a dose of 15 mg / kg b.w. once daily (Veraflox 0,25 ml) for 20 days is an effective way to successfully treat enterococcal infections in parrots. The administration of Augmentin (amoxicillin / clavulonic acid) orally at a dose of 100 mg / kg body weight twice daily is an effective therapy of streptococcal infections in parrots.

It is important that antibiotic therapy be accompanied by the use of general strengthening and immunostimulating agents.

Full nutrition, the addition of vitamins and good hygiene, the avoidance of stress factors and the prohibition of owners to kiss the birds on the beak are essential from a prophylactic point of view.

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