Case Report

Lung infection and severe anemia secondary to Balantidiasis in hamadryas baboons: A case report

O. AL-Tayib

Eng. A.B. Research Chair for Growth Factors and Bone Regeneration, College of Dentistry, King Saud University, Saudi Arabia.

*Corresponding author
Omar A. Al-Tayib
Email: al.tayibkomar@gmail.com

Abstract: Within the last decades hamadryas baboons have been extensively used as experimental models for a different type of studies in the biomedical research centers. Balantidium coli a protozoan parasite is commonly infects human and animals such as primates worldwide. Whoever, investigating zoonotic diseases and common infections of these non-human primates to man has a medical significance. This protozoa is usually occurs in the intestinal and it is well known cause of intestinal infection and dysentery in primates. Whoever, a case of balantidiasis complicated by severe pulmonary infection and resulting in iron deficiency anemia has not, to our knowledge, been described previously in baboons in the literature. We present a case of lung involvement and iron deficiency in baboons from Saudi Arabia. This case underlines that Balantidium coli should also be considered as a possible cause of extra-intestinal disorders and considered as part of the differential diagnosis of respiratory disorders in baboons in addition to the dysenteric form.

Keywords: Balantidium coli; Hamadryas baboon; extra-intestinal; lung; Saudi Arabia

INTRODUCTION

Within the last decades baboons had been used worldwide as animal models in biomedical studies in captive non-human primates (NHPs) colonies. Whoever, many of zoonotic diseases commonly infect primates are communicable to humans, and the risk of transmission of these pathogens is greater than with any other group of laboratory animals, because of the close phylogenetic relationship in between [1]. Balantidium coli (B. coli), is one of the ciliated protozoan parasites of the family of Balantidiida, that is commonly infects humans, NHPs, equines, cattle, swine, dogs, rats and pigs, and has a world-wide distribution [2-3]. Pigs act as carriers and are not often adversely affected by this organism and people in contact with pigs were more likely to be infected [4]. Whoever, in Muslim countries such as Saudi Arabia where domestic pigs are absent due to religious reasons, it seems that the fecal contamination of food and water sources with other animals feces such as baboons, wild boars, camels and/or human-to-human transmission are mainly involved and playing a big role in the sporadic transmission of this parasitic protozoan disease [5-6-7]. The natural habitat of B. coli is the large intestine, it is usually involves the colon of the patients. However, it is a well known cause of intestinal infection and dysentery and causes a variable clinic pictures, including abdominal pain, nausea, losing weight and bloody diarrhea [8]. The treatment of balantidiasis in animals is controlled effectively by using oxytetracycline antibiotic agents with higher efficacy [9]. Nevertheless, zoonotic infections in laboratory baboons as an experimental model have rarely been founding in the literature data from Saudi Arabia. In additions, extra-intestinal infections and cases of lung involvement from B. coli infections in experimental baboons have rarely been reported. Our study in this paper to our knowledge is the first reported case of respiratory out come and severe iron deficiency secondary to balantidiasis in baboon from Saudi Arabia. Whoever, parasitic infections may be worth considering in patients with cavitary lung involvement who have contact with the baboons’ colony.

CASE REPORT

The first case was a hamadryas baboon 4-year-old (5.2 kg body weight) male baboon, was examined for intermittent diarrhea, and abdominal pains. The clinical history revealed that the baboon had a severe watery diarrhea and anorexia that had developed during the previous four days. Supportive therapy was initiated and Amoxicillin (Betamox®) intramuscular injection was used for two days without improvement of the condition. Whoever, abdominal pains, fever, vomitting and more than five liquid stools per day were still present. When baboons in the colony are observed with watery diarrhea, routine management includes antibiotics and/or anti-worms were given.
when there are additional clinical signs of ill-health, considered a possible pathogen in animals with diarrhea a stool examination is recommended. Diarrhea in this baboon was associated with losing of appetite and lethargy. Thereafter, bloody mucous diarrhea was observed. During the physical examination, this baboon was febrile, and had signs of dehydration. Previous health checks, which include blood sampling (~5 ml) for laboratory examinations. In additions, fresh samples of feces had been taken and stored in universal 30ml labeled vials with at least 5g of fecal matter. Samples were stored in 10% formalin until available for laboratory processing. Transport time to the laboratory was 30- 45 min. Laboratory examination of the fecal samples revealed numerous mobile ciliated trophozoites around 50μm long and 35μm broad. These bodies were diagnosed as Balantidium coli trophozoites (Fig. 1). Treatment was commenced with intramuscular amoxicillin (Betamox®50mg/2times/daily) and oral metronidazole. The animal's clinical condition appeared to stabilize, but did not improve. However, two days later rapid death occurred and thus post-mortem examination of this animal was performed.

The second case was another hamadryas baboon- male (5 years old), this animal had been used experimentally for dental implant surgery procedures and it had also previously been in a good health. The occurrence of severe diarrhea was also associated with loss of appetite, fever and bloody diarrhea. On a routine fecal examination a plenty trophozoites of B. coli had been isolated as well. Therapy was instituted with combinations of subcutaneous injection of oxytetracycline and metronidazole (Flagyl®) twice daily/7 days. A 5-day treatment period was associated with a decrease in diarrhea, but the animals’ general condition did not improve despite dietary vitamin and fluid supplements. In view of this failure to recover the baboon subsequently underwent euthanasia. Post-mortem examination of case 1 and 2 were selected and all results and other ante-mortem findings were shown in Figure 2.

In case 3; a hamadryas baboon 4 years-old female was examined for intermittent bloody diarrhea and abdominal pains. The clinical history revealed that the baboon had a severe watery diarrhea and anorexia that had developed during the previous four days. Thereafter, bloody mucous diarrhea was observed. During the physical examination, this baboon was febrile, and had signs of dehydration. Fresh samples of feces had been taken and stored in universal 30ml labeled vials with at least 5g of fecal matter. Samples were stored in 10% formalin until available for laboratory processing. Laboratory examination of the fecal samples revealed numerous mobile ciliated trophozoites around 50μm long and 35μm broad as well, which identified as B. coli trophozoite. Supportive therapy was initiated and a short course of subcutaneous injection of enrofloxacin (Baytril®) and metronidazole twice daily/7 days had been given to this baboon to eradicate the infection. On the following day, a 5-day treatment period was associated with a decrease in diarrhea, whoever, a complete resolution was observed after SC rehydration and one week of treatment with this combination. Also, all the other clinical symptoms disappeared and a fresh fecal sample taken later from the baboon was negative for the intestinal parasites.

These baboons in laboratory tests showed a biologic alterations and showed anemia, dehydration with severe hypoalbuminemia and hyponatremia. The serum outcomes from blood samples of these baboons are shown in Table 1.

![Fig. 1: Balantidium coli (B. coli) the ciliated trophozoite in stool samples detected by microscopically examination (black arrow).](image-url)
**Fig. 2:** Two of the three experimental baboons infected by *B. coli*, after anesthetized with receiving an over dose of ketamine and xylazine. (A, B) A large part of the right upper lobe of the lung of 1<sup>st</sup> baboon was necrotic and infected producing an abscess; the reminder of the lobe was affected pneumonia. The responsible organisms were *B. coli* trophozoites. (C, D) lungs of the 2<sup>nd</sup> baboons showed pulmonary hemorrhagic, inflammatory mass in the lung was thought to be likely secondary to colonic balantidiasis.

**Table 1:** Changes of blood hematological and biochemical indices of *Hamadryas baboons* during *Balantidium coli* (*B. coli*) infection.

<table>
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<td>3</td>
<td>AST (u/l)</td>
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<td>5</td>
<td>Na (mm/l)</td>
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<sup>2</sup> PCV, packed cell volume; Hb, haemoglobin; ALB, albumin; AST, aspartate aminotransferase; ALT, alanine aminotransferase; * Baboon no.1; **Baboon no. 2; Baboon no.

**DISCUSSION**

Due to the medical and economic impact of this protozoon on public health issue, *B. coli* have been known for more than a century as zoonotic agents of human [10]. This protozoan parasite is usually associated with intestinal, and infects the caecum and colon of the patients causing diarrhea, and other gastrointestinal Symptoms, the disease caused by *B. coli* infection is called balantidiasis, and the transmission is direct/indirect and commonly occurs through contaminated water and/or food [11]. Whoever, in invasive cases, this protozoan parasite can invades the mucosa of the colon and extra-intestinal infections can occur, producing a local generalized peritonitis with perforations [12]. Balantidiasis involving extra-intestinal organs and causing clinical signs has rarely been reported. Whoever, in human medicine there have been several reports in the literature among the possible pathways of *B. coli* infection spreading from the site of colonic ulceration to the lungs, causing a pulmonary disease, when balantidia perforation the colon of the...
patient and spread through the peritoneal cavity via
circulatory or lymphatic systems to lung [13].
Furthermore, *B. coli* may across the diaphragm and
stabilized at the nasopharynx. However, lung infections
with *B. coli* had been reported in patients with an
association with pigs or pig manure, resulting from
aspiration of fluid from the oral cavity [14]. In addition
to that, several studies had been reported that, this
organism will perforate the large intestine and affect the
lungs with immunocompromised patients, however,
these individuals appear to be less resistant to
balantidiasis [15-8]; or probably pulmonary infection
may follow inhalation or ingestion of the manure [13-
16]. Moreover, *B. coli* can also involve the urinary
system through the blood stream and caused an
inflammatory reaction in the urine. Whoever, urinary
balantidiasis had been reported from old woman from
Iran cystitis associated with *B. coli* trophozoites in
bladder mucosa. Furthermore, two different studies
reported that *B. coli* trophozoites were repeatedly found
in the urine sediment [17-18]. Although, genitourinary
sites of infection in humans, including uterine infection,
vaginitis, and cystitis, are thought to occur via direct
spread from the anal area or secondary to rectovaginal
fistulas created from infection with *B. coli* [14]. More
recently, involvement of bone by *B. coli* had been
reported, and it case osteomyelitis of the spine [19].
A very rare previous report about the presence of extra-
intestinal balantidial infections have been published in
the literature at autopsy in animals with *B. coli* in fecal
samples of baboons. Whoever, *B. coli* was found in the
gastric lymph ducts and in the sub mucosa of the
abomasum at autopsy of barbarian sheep from Korea
and balantidia, however, were not found in the animal’s
stool [20]. In this case, there was no history of
environmental stress, ration change or concurrent
disease 5 months ago. The slighty increase and
decrease caused by balantidiasis in blood chemistry
values may be due to pathological lesions, bloody
diarrhea, severe hemorrhage, or digestive disturbances
[21]. Whoever, in these baboons, hematological values
showed severe anemia, hypo-albuminemia, hyponatremia,
and increases in serum (ALT) and (AST), and these findings was confirmed with the
serum changes due to this disease in primate which had
been reported earlier by Miller [22].

In human medicine previous studies examined
*B. coli* infection in lungs by using: Chest radiographs
(X-rays) and/or computerized tomography (CT) scans
of the thorax which showed deterioration and confirms
the diagnosis [14-16]. However, these are not available
always in the animal theaters. Tissues of infected
animals euthanized when moribund and tissue samples
postmortem; may shed little light on the pathogenesis of
balantidiasis in animals during times before death. The
diagnostic techniques of *B. coli* infection in both humans
and animal is based on microscopic detection of active
trichozoites and/or cysts in fecal samples and/or rectal
biopsy [6-23]. Whoever, in the cases of pulmonary
balantidiasis, examination of bronchoalveolar lavage
may be useful [15]. In the current case, diagnosis of
intestinal disease was established as a consequence of
clinical signs and the results of laboratory examinations.
Whoever, Chest X-rays and/or CT scan is not available,
and thus autopsy revealed lesions in the lungs. A
possible mechanism for lung infection, most likely
occurred secondary to colonic balantidiasis, and the
organism likely travelled across the diaphragm into the
pleural space causing this lung infection. Whoever, iron
deficiency anemia occurs secondary to putative
gastrointestinal bleeding and/or due to poor appetite.
Thus, further studies are needed to elucidate the mode
of action for this parasite among hamadryas baboons’
population.

Baboons had been used worldwide as animal
models in biomedical studies in captive NHPs colony.
Whoever, complicated lung diseases caused by *B. coli*
may vary from asymptomatic to acute respiratory
distress and causes significant confounders in primate’s
colonies and public health. Thus, unsafe handling of
animals, personal hygiene and contact with laboratory
animals should not be underestimated. Whoever, further
investigation is required to clarify the possible role of
the presence of baboons as reservoirs for different types
of human pathogens and/or the prevalence of various
zoonotic diseases in Saudi Arabia.

CONCLUSION

In conclusion the results of this report, demonstrated that multiple zoonotic infections from
experimental animal units are prevalent in some
localities in Saudi Arabia. Whoever, due to the clinical
importance of these infections for man and animals,
more attention should be given to zoonotic risk of
laboratory animals in public health management
activities. Critical health care management, new
diagnostic methods, knowledge of disease pathogenesis
and surveillance of zoonotic diseases are essential to
individuals who work closely with baboon models.
Although, extra-routine examinations techniques to
determine the prevalence of the various species of
intestinal protozoa including tomography scans and X-
rays showed lung and/or extra-intestinal lesions for
*B. coli* infection are also such needed.

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