

## Case Report—

## Fibrino-Necrotic Typhlitis Caused by *Escherichia fergusonii* in Ostriches (*Struthio camelus*)

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**SUMMARY.** Two adult ostriches developed anorexia, prostration, and severe hemorrhagic diarrhea, dying 24 hr after the onset of clinical signs. On postmortem examination, the cecal mucosa showed locally extensive areas of hemorrhages and fibrino-necrotic typhlitis with a white-yellowish material covering the mucosal surface. Multiple serosal petequeal hemorrhages and fibrinous peritonitis were present. Histologic examination revealed an intense mononuclear infiltration in the lamina propria and submucosa of the cecum and extensive superficial necrosis associated with fibrin and serocellular deposits. Several gram-negative bacterial colonies were observed within the necrotic areas. Samples from intestinal lesions were collected, and pure growth of *Escherichia fergusonii* was obtained. *Escherichia fergusonii* is a member of *Enterobacteriaceae*, closely related to *Escherichia coli* and *Shigella* sp., established as a new species of the genus *Escherichia* in 1985. In veterinary medicine, *E. fergusonii* has been reported in calves and sheep from clinical cases suggestive of salmonellosis. To our knowledge, this report represents the first description of *E. fergusonii* associated with enteritis in ostrich.

**RESUMEN.** *Reporte de Caso*—Tiflitis fibrino-necrótica causada por *Escherichia fergusonii* en avestruces (*Struthio camelus*).

Dos avestruces adultas mostraron anorexia, postración, y diarrea hemorrágica severa, muriendo 24 horas posteriores al comienzo de los signos clínicos. En la necropsia, la mucosa del ciego se mostró hemorrágica y con tiflitis fibrino-necrótica con presencia de un material blanco-amarillento cubriendo la superficie de la mucosa. Se observaron hemorragias petequeales en múltiples áreas de la serosa así como peritonitis fibrinosa. La evaluación histológica reveló una infiltración mononuclear intensa en la lámina propia y la submucosa del ciego y una necrosis superficial extensa asociada a la fibrina y a los depósitos serocelulares. Se observó una gran cantidad de colonias bacterianas gram negativas dentro de las zonas necróticas y de las muestras obtenidas de las lesiones se aisló en cultivo puro la bacteria *Escherichia fergusonii*, miembro de la familia *Enterobacteriaceae*, muy relacionado con *Escherichia coli* y *Shigella* sp., estableciéndose como una nueva especie del género *Escherichia* en 1985. En medicina veterinaria, *Escherichia fergusonii* ha sido reportada en becerros y ovejas con signos clínicos relacionados con salmonelosis. Hasta donde conocemos, este reporte representa la primera descripción de *Escherichia fergusonii* asociada con enteritis en avestruces.

**Key words:** fibrino-necrotic enteritis, bacterial enteritis, *Escherichia fergusonii*, ostrich

Gastrointestinal diseases are considered one of the most frequent and economically important pathologies in ostrich farms. Predisposition factors such as poor management conditions, stress, and other concomitant diseases contribute to the development of these pathologies, which are primarily caused by bacterial infections. *Escherichia coli*, *Campylobacter jejuni*, *Pseudomonas aeruginosa*, *Salmonella* sp., and *Clostridium* sp. are the bacterial pathogens most frequently involved in infectious enteritis in ostriches (16).

*Escherichia fergusonii* was established as a new species of the genus *Escherichia* in 1985 (6), and in 1989 Richard contributed to the microbiologic characterization of this enterobacteria (13). To date, only a few clinical cases have been reported both in human and veterinary medicine. In 1993, Funke and others isolated *E. fergusonii* from gallbladder, blood, and feces in a patient with pancreatic carcinoma and cholangiosepsis, indicating a pathogenic potential in human beings (7). The first description in veterinary literature of *E. fergusonii* was reported by Bain and Green in 1999 (1), who described the isolation of this enterobacteria in calves and sheep from clinical cases suggestive of salmonellosis. This short communication is believed to be the first description of the association between *E. fergusonii* and fibrino-necrotic enteritis in ostriches.

### CASE REPORT

Two 2-yr-old ostriches developed anorexia, prostration, and hemorrhagic diarrhea, dying 24 hr after the onset of clinical signs.

The animals came from a small farm that served zoologic show and educational purposes; the farm comprised 14 adult ostriches (nine females and five males) that were fed with commercial rations and kept in a short walking yard. One month before the beginning of the outbreak, the farm was moved from a previous emplacement, and the number of daily visitors had increased. The ostriches were in close contact with other domestic and exotic birds (hens, turkeys, peacocks, etc.) and mammals (goats, sheep, cows, and donkeys), and no vaccination program had been developed. Moreover, the farm had a high previous incidence of stress and poor management-related diseases, including low fertility index, impaction of the proventriculus, gastrointestinal foreign bodies, and bacterial enteritis.

Postmortem examination showed intense congestion of the posterior intestine with a diffuse serofibrinous peritonitis. Cecal mucosa showed locally extensive areas of hemorrhage and fibrino-necrotic typhlitis, with a white-yellowish material covering the mucosal surface (Fig. 1). Multiple petequeal hemorrhages were presented in the serosa through the digestive tract and the epicardium. Histologic examination revealed an intense edema and mononuclear infiltration in the lamina propria and submucosa of the cecum. The cecal mucosa showed an extensive superficial necrosis mixed with fibrin and serocellular deposits composed of granulocytes and cellular debris (Fig. 2).

Several gram-negative bacterial colonies were detected at the edge and within the necrotic areas (Fig. 2, inset). Samples from intestinal lesions, blood, liver, and spleen were collected and cultured on blood

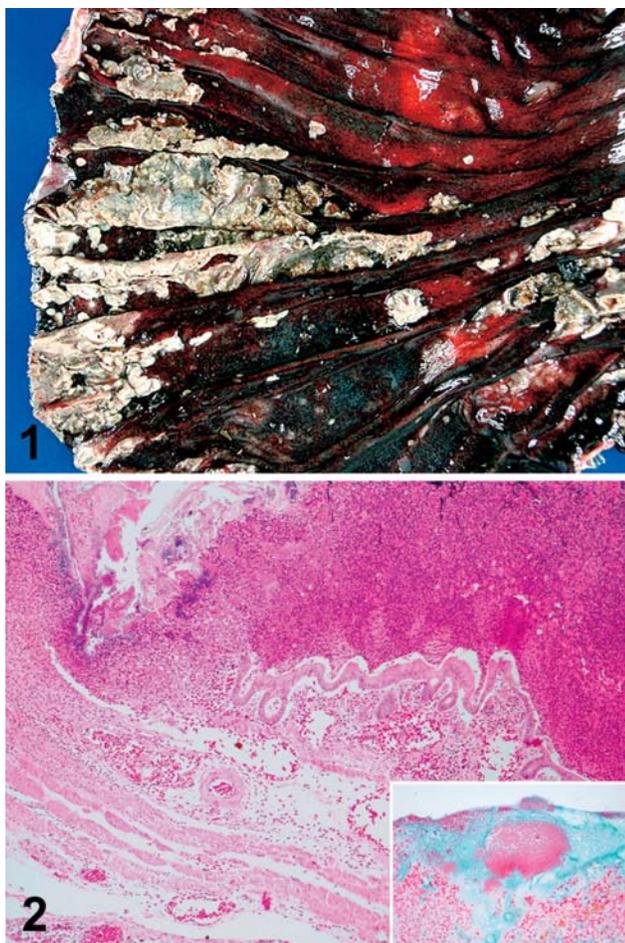


Fig. 1. Cecal mucosa showing locally extensive areas of hemorrhage and fibrino-necrotic enteritis with a white-yellowish material covering the mucosal surface.

Fig. 2. Cecal mucosa. Extensive mucosal necrosis covered by a rich fibrino-purulent exudate. Hematoxylin & eosin stain. 100 $\times$ . (Inset) Gram-negative bacterial colonies present within the necrotic areas. Gram stain. 400 $\times$ .

agar, MacConkey agar, Baird Parker agar base, and Sabouraud dextrose agar. Culture revealed pure growth composed of negative-lactose colonies on the MacConkey agar medium and blood agar plate. These colonies consisted of oxidase-negative, gram-negative bacilli. Samples were also cultured onto an enrichment, *Salmonella*-selective Hektoen Enteric agar and incubated at 37 C for 24 hr; no additional bacterial growth was noted. Strains were identified using API 20 E (BioMérieux, Madrid, Spain). The microorganism was identified as *E. fergusonii*.

Ostriches are susceptible to virus, and electron microscopy has been used to detect virus in gut content and intestinal tissues samples (5). Intestinal samples were refixed in 2.5% glutaraldehyde. After embedding in epoxy resin, thin sections were cut on LKB ultramicrotome (Ultratome Nova, Bromma, Sweden). Subsequently, sections were stained with uranyl acetate-lead citrate and examined with a Philips CM 10 transmission electron microscope. No viruses or virus-like particles were detected. In addition, gastrointestinal parasites were not detected on coprologic and histopathologic study.

On the basis of the gross lesions, the demonstration of gram-negative bacterial colonies in histologic sections, and the microbi-

ological isolation and biochemical identification of this microorganism, a diagnosis of fibrino-necrotic typhlitis and septicemia caused by *E. fergusonii* was made.

## DISCUSSION

The intestinal lesions described in our animals comprised severe fibrino-necrotic typhlitis in association with fibrinous peritonitis and multifocal serosal hemorrhages. Gastrointestinal diseases in ostrich have been noted to be complex and multifactorial in origin when virus, parasites, and bacteria have been involved (9,12,16). Only a small variety and low incidence of viruses have tropism for the digestive tract of ostrich, including coronavirus, circovirus, enterovirus, and the Newcastle disease virus, which is considered the most important and frequent virus (5,16). Enteric parasites in ostrich are also described to have low incidence, and the susceptibility to coccidia, which frequently cause necrotic enteritis in other avian species, is still controversial in ostrich pathology (9,11,12). Among bacterial pathogens, *Salmonella* sp. and *Clostridium* sp. are considered to be the most important species causing necrotic enteritis in ostriches (8). The ultrastructural study performed from intestinal lesions did not reveal viruses or virus-like particles, and no parasites were detected in the animals presented here. Moreover, on bacterial culture from enteric lesions, blood, liver, and spleen samples, pure growth of *E. fergusonii* was obtained, indicating its primary role in this case.

*Escherichia fergusonii* is a member of Enterobacteriaceae family and is closely related to *Escherichia coli* and *Shigella* sp. The enteropathogenicity of this bacteria has been previously described. In 1999, Chaudhury and others (4) showed the diarrheagenic capacity of *E. fergusonii* by studying diarrheal stools from infected rats, and Bain and Green (1) isolated this enterobacteria from animals with enteritis. However, the pathogenic mechanisms of *E. fergusonii* have not been completely established. *Escherichia fergusonii* has been postulated to be an opportunistic pathogen, and as is the case with *E. coli*, its pathogenic capacity depends on debilitating factors such as mucosal barrier impairment, immunosuppression, and poor management conditions (10,14). It is possible that the animals in this study carried *E. fergusonii* in their guts and that concomitant factors triggered the development of the enteric disease. Ostriches are extremely susceptible to stress, which has been postulated in avian pathology to contribute to the penetration of *E. coli* into the bloodstream via intestinal mucosa, causing severe septicemia as occurred in our case (10). The farm in our study had a high previous incidence of poor management and stress-related pathologies, such as low fertility, stomach impaction, gastrointestinal foreign bodies, and bacterial enteritis. Stress and poor management were, in our opinion, predisposing factors in the present case. Moreover, it is well-known that stress can alter the normal bacterial flora causing intestinal dysbiosis. Previous studies have shown the capacity of *E. fergusonii* to produce colicins similar to those produced by *E. coli* (15). Bacteria capable of producing colicins can persist in the intestinal tract longer and in greater numbers than can nonproducer strains, increasing their ability to colonize the intestinal tract (3,17).

The source of *E. fergusonii* infection in the present case remains unknown, although two probable hypotheses could be pointed out. Firstly, the ostriches in our case could be nonapparent carriers for *E. fergusonii*. Although the veterinary literature does not describe previous data related to the prevalence of this microorganism in ostriches, this bacteria has been described in other avian species to be constitutive of intestinal flora (2). And secondly, the transmission of *E. fergusonii* to our ostriches could be due to the close contact with

potential reservoir species, including other domestic and exotic birds and mammals (cows, goats, and sheep).

To our knowledge, this report represents the first description of isolation of *E. fergusonii* from fibrino-necrotic typhlitis in ostriches, showing that these birds are susceptible to this etiologic agent. Further studies are required in order to determine the prevalence of this microorganism in ostrich. *Escherichia fergusonii* should be included with other etiologic agents in the differential diagnostic of necrotic enteritis in ostriches.

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