

EFFECTIVE THERAPEUTIC APPROACH TO HAEMORRHAGIC CYSTITIS IN A CAPTIVE ASIAN ELEPHANT (*ELEPHAS MAXIMUS*)

ABSTRACT

A 35-year-old female Asian elephant from a Hindu temple presented with decreased appetite, anorexia and bloody urination for 10 days, unresponsive to prior treatment. Clinical signs included lethargy, reduced movement and haematuria with clotted blood. Diagnostic evaluation revealed mild leukocytosis, elevated serum creatinine and BUN, proteinuria, red blood cells and leukocytes in urine, with calcium oxalate crystalluria and bacterial presence. Urine culture confirmed *Staphylococcus* spp. sensitive to enrofloxacin making it a suitable treatment option. The animal was treated with intravenous enrofloxacin, flunixin meglumine and fluids were given for hydration. Uneventful recovery was noticed after 21 days of continuous clinical care of the elephant. This study revealed successful therapeutic management of haemorrhagic cystitis in an Asian elephant. This therapeutic approach should be explored more extensively in similar cases and across different animal species, given the scarcity of research in this area.

KEYWORDS: Asian elephant, pyelonephritis, *Staphylococcus* sp., calcium oxalate crystals.

INTRODUCTION

India has a long fascinating history of domesticating wild elephants. Captive Asian elephants have been very closely associated and deeply entwined with the religion, myths and cultural heritage of India for centuries [1] (Kumar *et al.*, 2019). Elephants have adapted to a wide variety of environments in captive conditions. The health status of captive elephants depends on various factors including body mass index, husbandry management, nutrition and infectious and non-infectious diseases [2] (Mikota *et al.*, 1994). The health and disease related information in captive elephants is still in a state of infancy in India. Elephants are prone to a variety of infectious and non-infectious diseases; but recognizing that they are even sick may be difficult and challenging [3] (Miller and Fowler, 2015). Understanding the health-related parameters and evidence of diseases in captive-reared elephants will be significantly helpful towards enriching the management as well as their healthcare.

Cystitis refers to inflammation of the bladder, which can have various causes depending on the species [4] (Li and Leslie, 2023). Haemorrhagic cystitis is a type of bladder inflammation where both infectious and non-infectious factors cause bleeding from the bladder lining [5] (Manikandan *et al.*, 2010). It is typically marked by haematuria, painful urination and frequent urination. Common bacterial pathogens causing haemorrhagic cystitis include *Escherichia coli*, *Staphylococcus saprophyticus*, *Proteus mirabilis* and *Klebsiella* species [6] (Krane and Levine, 1992). Fungal pathogens linked to this condition include *Cryptococcus neoformans*, *Candida albicans*, *Aspergillus fumigatus* and *Torulopsis glabrata* [7] (Balakrishna *et al.*, 2024). Renal disease occurs infrequently in elephants [8] (Fowler and Mikota., 2006). But reports on cystitis in elephants are rare. There has been only one report of pyelonephritis in an Asian elephant [9] (Sanchez *et al.*, 2004) provides important updated clinicopathological information about urinary tract infections in Asian elephants. This study addresses the successful therapeutic management of haemorrhagic cystitis in a female Asian elephant.

MATERIALS AND METHODS

A female Asian elephant belonging to a Hindu religious temple with the age of 35 years had a history of decreased appetite, anorexia and voiding bloody urination for 10 days. Treatment of elephant by local veterinarian for 5 days was futile. A medical team was called from Veterinary college and Research Institute, Orathanadu for the diagnostic visit.

On clinical examination the elephant was looking dull, lethargy, decreased movement, shifting of legs were noticed. Further the elephant was observed to have haematuria and expelling infrequent clotted blood from urinary tract. Tentatively it was diagnosed as Urinary tract Infection. Vital parameters viz. Rectal temperature, respiratory and heart rate were observed to be unremarkable. Clinical samples such as dung, whole blood, blood smear, serum, trunk wash, Urine and swabs from vaginal area for culture and cytology were collected for disease investigation. The complete blood count revealed a mild leukocytosis that increased to $26.5 \times 10^3/\text{cmm}$, with specific elevation in neutrophils. Biochemical analysis of the serum revealed the increase in serum creatinine (3.04mg/dL) and BUN (80 mg/dL), whereas urinalysis showed the presence of leukocytes, proteinuria and red blood cells in urine; urinary sediment examination evidenced the calcium oxalate crystalluria along with numerous bacteria and degenerated leucocytes. Vaginal cytology showed normal squamous

cells and non-nucleated squamous cells along with numerous bacteria. Culture of urine revealed a pure growth of *Staphylococcus* spp. that was sensitive to Enrofloxacin. No evidence of blood parasite and endoparasites in blood smear study and dung sample examination respectively. Based on the clinical observation and laboratory findings the case was confirmed as haemorrhagic cystitis.

The elephant was treated parenterally with Inj. Enrofloxacin @5mg/kg B.W. I/V, Inj. Flunixin meglumine @1mg/kg B.W I/V., Inj. Ringers lactate @8 litres I/V, Inj. Normal saline @4 litres I/V, Inj. Chlorpheniramine maleate and Inj. Tranexamic acid @15ml as total dose I/M for 10 days. Hematinic syrup twice a day regularly was administered orally.

RESULTS AND DISCUSSIONS

After 3 weeks of monitoring, the elephant's hemogram and serum biochemistry were within normal ranges. However, urinalysis revealed the presence of Red Blood Cells and White Blood Cells. A subsequent urine culture from a free-catch sample revealed negative for the growth of the infective cause *Staphylococcus* sp. Based on antibiotic susceptibility testing (ABST), enrofloxacin demonstrated strong efficacy against *Staphylococcus* species, making it a suitable treatment option.

Haemorrhagic cystitis has been reported in various species, including cats, humans, Grant's gazelles, cattle and horses. Causes vary by species: environmental or behavioural factors in cats, viral or drug-related causes in humans, idiopathic factors in gazelles and viral or toxic factors in cattle. In horses, it may occur as a rare primary condition or secondary to bacterial infections, urolithiasis, periparturient trauma, bladder paralysis or phenylbutazone administration [10] (Rasool *et al.*, 2023). The diagnosis of nephritic conditions in large animals typically involves a thorough approach including physical examination, haematology, urinalysis, ultrasound, endoscopy and biopsy [11] (Divers and Yeager, 1995). For cystitis, the diagnosis is often based on the combination of history, clinical signs, hematobiochemical analysis and urinalysis.

Haemorrhagic cystitis, a form of bladder inflammation marked by the presence of blood in the urine, can be differentiated from pyelonephritis through clinical signs and laboratory findings. In cases of pyelonephritis, as reported by [9] Sanchez *et al.* (2004) in a 37-year-old female Asian elephant, elevated serum creatinine (300.56 mmol/L) and BUN (7.14 mmol/L) levels were noted, which is commonly associated with kidney dysfunction.

Clinical signs in animals with pyelonephritis, such as fever, dysuria (which can manifest as haematuria or pyuria), weight loss, anorexia and depression, also correlate with findings in other species like cattle and horses [12] (Divers, 2002). These animals may demonstrate systemic illness with signs of renal compromise, often including lameness due to referred pain from the kidneys [8] (Fowler and Mikota, 2006). In our case, while we observe similar urinary signs, such as haematuria, the primary distinction lies in the absence of renal involvement, which is a hallmark of haemorrhagic cystitis. Furthermore, pyelonephritis infection ascends from the urinary tract to the kidneys, typically causing nephritis and in less extent haemorrhagic cystitis, primarily limited to the bladder. Haemorrhagic cystitis is characterized by bladder inflammation due to bacterial infection, trauma or irritation which results in the presence of blood in the urine. The bacteria involved in haemorrhagic cystitis can include species like *Escherichia coli*, *Streptococcus* or *Staphylococcus*, as seen in various large animals and small animals [13] (Greene, 2006) including elephants [8] (Fowler and Mikota, 2006).

The mechanism of haemorrhagic cystitis often involves an ascending infection that irritates the bladder lining, causing bleeding and resulting in the appearance of blood in the urine. This condition is typically more localized to the bladder and does not involve the kidneys as seen in pyelonephritis. In contrast, pyelonephritis, with its systemic signs of kidney dysfunction (e.g., elevated creatinine and BUN), typically presents with more severe signs of systemic infection and renal involvement. In the case of haemorrhagic cystitis, the main risk factors include bacterial infections, trauma, urinary stasis or structural abnormalities in the urinary tract. The fluoroquinolone antibiotic works by inhibiting bacterial DNA gyrase, effectively preventing bacterial replication. Its broad-spectrum activity and good tissue penetration contribute to its effectiveness in managing infections caused by *Staphylococcus* sp.

Both conditions share some common symptoms, including dysuria and haematuria, but the key difference lies in the systemic involvement of the kidneys in pyelonephritis, as well as the degree of inflammation and potential for kidney damage. While pyelonephritis often results in significant renal impairment and requires more aggressive management, haemorrhagic cystitis is typically more localized and may resolve with targeted treatment focused on the bladder, such as appropriate antibiotics, anti-inflammatory medications and

supportive care. This paper reports the successful therapeutic management of haemorrhagic cystitis in an Asian elephant.

CONCLUSION

Haemorrhagic cystitis is an uncommon problem in Asian elephants. This case study reports successful therapeutic management of haemorrhagic cystitis in an Asian elephant. The clinical sign noted were haematuria, dribbling of urine, reduced movement and lethargy. Haemotobiochemical analysis revealed mild leukocytosis, elevated BUN and serum creatinine proteinuria and urinalysis revealed red blood cells and leukocytes in urine, with calcium oxalate crystalluria. The animal was treated with intravenous enrofloxacin, flunixin meglumine and fluids were given for hydration. Enrofloxacin considered as strong efficacy against the organisms caused (*Staphylococcus* spp.) haemorrhagic cystitis in this case. This therapeutic approach should be explored more extensively in similar cases and across different animal species, given the scarcity of research in this area.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

REFERENCES

1. Kumar N, Natarasan K, Sugumar K, Kumar VS, Velmurugan R and Shanmugaundaram P. Therapeutic management of wounds in Asian elephants. *Drug Invent Today* 2019;11(2):217–220.
2. Mikota SK, Sargent EL and Ranglack GS. *Medical management of the elephant*. West Bloomfield (MI): Indira Publishing House; 1994. p. 1–298.
3. Miller RC and Fowler ME. *Fowler's Zoo and wild animal medicine*. St. Louis (MO): Elsevier; 2015.

4. Li R and Leslie SW. Cystitis. In: StatPearls Publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK482435/>
5. Manikandan R, Kumar S and Dorairajan LN. Haemorrhagic cystitis: A challenge to the urologist. *Indian J Urol* 2010;26(2):159–166.
6. Krane DM and Levine LA. Haemorrhagic cystitis. *AUA Update Ser* 1992; XI (31).
7. Balakrishna VH, Katoch A, Sharma A, Wadhwa DR, Kumar A, RK A, Kumar A, Bhawani I and Singh J. Management of haemorrhagic cystitis in dogs. *Indian J Vet Med* 2024;42(2):81–86.
8. Fowler ME and Mikota SK. *Elephant biology, medicine, and surgery*. 1st ed. Carlton (Victoria): Blackwell Publishing Asia; 2006.
9. Sanchez CR, Murray S, Montali RJ and Spelman LH. Diagnosis and treatment of presumptive pyelonephritis in an Asian elephant (*Elephas maximus*). *J Zoo Wildl Med* 2004;35(3):397–399.
10. Rasool A, Bharathidasan M, Sarath T and Patil A. Diagnostic and therapeutic insights into cystitis in a pregnant mare. *Int J Zool Appl Biosci* 2023;8(6):33–36. <https://doi.org/10.55126/ijzab.2023.v08.i06.005>
11. Divers TJ and Yeager AE. The value of ultrasonographic examination in the diagnosis and management of renal diseases in horses. *Equine Vet Educ* 1995; 7:334–341.
12. Divers TJ. Urinary tract infections. In: Smith BP, ed. *Large animal internal medicine*. 3rd ed. St. Louis (MO): Mosby Inc; 2002. p. 834–836.
13. Greene CE. *Infectious diseases of the dog and cat*. 3rd ed. St. Louis (MO): Elsevier Saunders; 2006.