Management of intertarsal septic arthritis in an ostrich (Struthio camelus)

Melanie J. Peel¹,² | Rodrigo S. Garcés Torres¹ | Marina Ivančić³ | Benjamín E. Alcántar Hernández¹

Abstract
A 7-year-old female ostrich (Struthio camelus) presented with lameness, left intertarsal joint swelling and a healing wound on the caudomedial aspect of the joint. Synovial culture revealed Corynebacterium species and radiographs were consistent with progressive septic arthritis. Multiple treatments were attempted including through-and-through joint lavage, intra-articular antibiotics, caudomedial arthrotomy, and regional limb perfusion in conjunction with systemic antibiotics and analgesia. Euthanasia was ultimately performed due to prolonged recumbency and poor prognosis. This report describes novel therapies and a surgical approach utilized for treatment of intertarsal septic arthritis in an ostrich and exemplifies the poor prognosis described in other species presenting with non-responsive septic arthritis of critical joints.

KEYWORDS
avian, arthrotomy, Corynebacterium, ratite

1 | CASE PRESENTATION

A 7-year-old, 118 kg, female ostrich (Struthio camelus) with a body condition score of 5/9 presented with an acute grade 3 left limb lameness (Kestin et al., 1992). On distant visual assessment, the patient had intertarsal (tibiotarsal-tarsometatarsal) joint swelling and a healing caudomedial wound just distal to the joint. The ostrich was housed in a free-ranging exhibit with several species of African hoof stock.

Chemical immobilization was performed with tiletamine-zolazepam (3 mg/kg IM, Dechra Veterinary Products, Overland Park, KS, USA) and medetomidine (0.2 mg/kg IM, Zoopharm, Laramie, WY, USA). Anaesthesia was maintained with isoflurane (VetOne, Boise, ID, USA), administered via an 18-French endotracheal tube with supplemental oxygen. On examination, the left intertarsal joint was warm and exhibited significant palpable effusion. The wound on the caudomedial aspect exhibited no discharge or exposed tissues and had prominent callous formation. Using standard chlorhexidine and saline, the wound and joint were cleaned and aseptically prepared for arthrocentesis. An 18-gauge needle was inserted into an area of fluctuant swelling on the caudolateral aspect of the joint. Synovial fluid was grossly turbid, tan and exhibited decreased viscosity. A marked heterophilic rich exudate consisting of a mixed population of degenerate and toxic heterophils was seen utilizing a modified Romanowski stain (Rapid Differential Stain, VetOne, Meridian, ID, USA) on in-house cytology with no pathogens noted. Radiographic evaluation revealed moderate circumferential soft tissue thickening of the intertarsal joint, with large osseous defects in the caudoproximal tarsometatarsus, multiple abnormal intra-articular bone fragments, and proximal irregularity of the lateral condyle of the distal tibiotarsus (Figure 1a).

In attempts to eliminate inflammatory mediators and possible pathogens from the joint, a through-and-through joint lavage was performed (Muron et al., 2016). Due to patient positioning and location...
Struthiocamelus diagnosis of intertarsal septic arthritis in an ostrich (Struthio camelus). One day post-clinical presentation. The "L" marker indicates the cranialateral surface. There is proximal and caudal soft tissue thickening, severe lysis of the caudal aspect of the proximal tarsometatarsus, and irregular bone fragments caudal to the joint. Radiographs were repeated under anaesthesia which revealed progressive soft tissue thickening, irregular periosteal proliferation along the proximal tarsometatarsus and development of joint space collapse.

Lameness and effusion remained static over the course of two weeks following the initial presentation. On day 15 post-presentation, radiographs and transarticular lavage were repeated under the same anaesthetic protocol mentioned previously, following collection of synovial fluid into a sterile, transfer media culturette for aerobic culture at a local laboratory (IDEXX, Memphis, TN, USA). Aerobic cultures were performed using both Macconkey and blood agars at 35°C.

Followingsurgery, medication regimens were continued, and physical therapy was enacted. A sling was placed on the sternum and on the pelvis just caudal to the femur three times daily to aid in standing and passive range of motion for 5–10 min. Despite therapy, the ostrich remained non-ambulatory and experienced a 30% weight decrease resulting in a 2/9 body condition score. On day 49 post-presentation, radiography was repeated under anaesthesia which revealed progression of disease and development of joint space collapse (Figure 1c). Decubital ulcers were noted on the keel and posterior aspect of both intertarsal joints, and crepitus was present on the contralateral intertarsal joint due to development of arthritis. Due to progression of disease, poor prognosis and declining quality of life, euthanasia was elected. Gross necropsy and post-mortem histopathology confirmed septic arthritis with osteomyelitis.
2 | DISCUSSION

Septic arthritis is not an uncommon diagnosis in both exotic and domestic animals presenting with lameness (Amer et al., 2019; Baron et al., 2019; Harcourt-Brown, 2002; Innes, 2016; Marcon et al., 2019; Mulon et al., 2016; Nairn, 1973). In birds, most diagnoses of this ailment are related to the extension of pododermatitis, traumatic events occurring near a joint or hematogenous spread of bacteria (Amer et al., 2019; Baron et al., 2019; Harcourt-Brown, 2002; Knafo et al., 2019; Marcon et al., 2019; Nairn, 1973; Ratliff & Zaffarano, 2016; Yousef et al., 2019). There are few publications about the diagnosis and management of intertarsal septic arthritis in avian species, and none have been reported in an ostrich (Amer et al., 2019; Marcon et al., 2019; Nairn, 1973). Although surgical management of phalangeal septic arthritis in an ostrich has been described, the critical nature of the intertarsal joint (particularly in this large, flightless species) made this case a unique challenge (Burba et al., 1996). Minimal literature for this disease process in ratites makes both treatment and determination of prognosis difficult.

To the author’s knowledge, this is the first published report of Corynebacterium septic arthritis in a ratite. Corynebacterium is a notoriously difficult to eliminate, gram-positive, non-spore-forming bacillus (Boltin et al., 2009; Funke et al., 1997). This bacterium is typically an opportunistic, environmental pathogen that was likely introduced or migrated into the joint from the proximate wound (Funke et al., 1997).

Despite broad spectrum antibiotics and copious flushing, it is unlikely full clearance of this organism would have been achieved. In mammalian species, necessary therapies for septic arthritis due to environmental pathogens, such as Corynebacterium and Arcanobacterium, often require a combination of transarticular lavage, systemic and intra-articular antibiotics, arthroteromies, and intra-articular drains (Desrochers, 2004). Due to avian physiology and the nature of the species, a drain was not a viable option (Smith et al., 1998). Avian abscessation is not conducive to active drainage, and formation of caseous exudate likely resulted in an environment which harboured the bacterium (Smith et al., 1998).

This report also presents novel therapies not previously described in ratites. A regional limb perfusion (RLP) was performed to aid in the treatment of septic arthritis by increasing drug concentrations in tissues not well vascularized (Knafo et al., 2019). In recent years, this technique has been briefly described and utilized in the avian model, allowing for extrapolations to be made for ratite medicine (Knafo et al., 2019; Ratliff & Zaffarano, 2016). The technique for RLP is relatively simple and should be considered for aggressive treatment of septic arthritis and other inflammatory conditions of the distal extremity in ratites.

An arthrotomy was also performed utilizing a novel caudomedial approach based on lesion location. A similar technique has also been described for treatment of a distal tibiotarsal bone cyst in an ostrich utilizing a dorsomedial approach (Tully et al., 1995). In ostriches, nearly all vasculature, ligaments, tendons and nerves are located on the posterior, anterior, medial or lateral surfaces of the distal extremity, allowing for oblique approaches to the joint (Hutchinson et al., 2015; Smith et al., 1998). The distal articular surface of the tibiotarsal bone is convex, with medial and lateral condyles of the tibiotarsus articulating with the concave cotyles of the proximal tarsometatarsus. This anatomy can lead to decreased visualization of all articular surfaces (Hutchinson et al., 2015; Schaller et al., 2009). Caution should be taken if attempting to locate a lesion in the central portion of the articular surface (i.e., the intercondyloid fossa).

Most importantly, determining integrity of the intertarsal joint is critical for treatment success. There are complex ligamentous and osseous anatomical structures needed for proper biomechanics of ostrich ambulation, including the engage-disengage system (Schaller et al., 2009). For appropriate range of motion, the ostrich intertarsal joint require at least 168° of extension and 80° of flexion, achieved during daily physical therapy for this patient (Schaller et al., 2009). The menisci, tendons and ligamentous apparatus are necessary for swing

---

**FIGURE 2** Caudomedial intertarsal arthrotomy approach in an ostrich (Struthio camelus) for management of septic arthritis. (a) Fibrinous and caseous material is seen within the intertarsal joint on initial caudomedial approach. Caudal is to the left of the photo. (b) Seven days post-op healing of intertarsal joint arthrotomy.
phase mechanics and passive locomotion that allow for decreased energy expenditure and appropriate movement (Schaller et al., 2009). Pathology involving this apparatus can lead to inefficient or complete loss of ambulation, as seen in this case. More specifically, osteomyelitis affecting the articular surfaces in conjunction with severe fibrous adhesions disrupting ligamentous and joint capsule integrity contributed to causes of prolonged recumbency and decubital sequelae. The complex nature of the intertarsal joint of ostriches and other ratites may be a limiting factor when managing non-responsive septic arthritis. Improved clearance of pathogens within the joint may be possible with more aggressive therapies, such as an arthrotomy and RLP at time of presentation. Caution is advised if significant osteomyelitis involving the articular surfaces has already occurred, as return to full function may not be possible.

3 | CONCLUSION

The novel therapies utilized in this report are areas of interest for further research to determine efficacy of regional limb perfusions and success of arthrotonies in ratites. Additional work is also needed in determining prognosis of infections involving Corynebacterium and cases of non-responsive septic arthritis of the intertarsal joint.

ACKNOWLEDGEMENTS

We wish to thank the ungulate department at Wildlife Safari and rotating fourth year veterinary students for their assistance and diligence in the care and treatment of this ostrich.

CONFLICT OF INTEREST

The authors report no interest in production of this manuscript.

ETHICS STATEMENT

The authors confirm that the ethical policies of the journal, as noted on the author guidelines page, have been adhered to. No ethical approval was required as this was a case report.

AUTHOR CONTRIBUTIONS

Melanie J. Peel: Conceptualization; Data curation; Investigation; Methodology; Project administration; Writing-original draft; Writing-review & editing. Rodrigo S. Garcés Torres: Conceptualization; Data curation; Investigation; Methodology; Project administration; Writing-review & editing. Marina Ivančić: Formal analysis; Writing-original draft; Writing-review & editing. Benjamin E. Alcántar Hernández: Conceptualization; Investigation; Methodology; Project administration; Writing-original draft; Writing-review & editing.

REFERENCES

Amer, M. M., Mekky, H. M., & Fedawy, H. S. (2019). Molecular identification of Mycoplasma synoviae from breeder chicken flock showing arthritis in Egypt. Veterinary World, 12, 535–541. https://doi.org/10.14202/vetworld.2019.535-541.

Baron, H. R., Phalen, D. N., Silbanose, C.-D., Binoy, A., & Azmanis, P. N. (2019). Multicentric septic osteomyelitis and arthritis caused by Staphylococcus aureus in a Gyrfalcon (Falco rusticolus). Journal of Avian Medicine and Surgery, 33, 406–412. https://doi.org/10.1647/2018-408.

Boltin, D., Katzir, M., Bugoslavsky, V., Yalashvili, I., Brosh-Nissimovet, T., Fried, M., & Elkahyam, O. (2009). Corynebacterium striatum–A classic pathogen eluding diagnosis. European Journal of Internal Medicine, 20, e49–52. https://doi.org/10.1016/j.ejim.2008.08.009.

Burba, D. J., Tully, T. N., Pechman, R. D., & Carnick-Seahorn, J. L. (1996). Phalaengel amputation for treatment of osteomyelitis and septic arthritis in an Ostrich (Struthio Camelus). Journal of Avian Medicine and Surgery, 10(1), 19–23.

Desrochers, A. (2004). Septic arthritis. In S. Fubini and N. Ducharme (Eds.), Farm animal surgery (1st ed., pp. 330–336). Elsevier.

Funke, G., von Graevenitz, A., Claridge, J. E., & Bernard, K. A. (1997). Clinical microbiology of coryneform bacteria. Clinical Microbiology Reviews, 10, 125–59.

Harcourt-Brown, N. H. (2002). Orthopedic conditions that affect the avian pelvic limb. Veterinary Clinics of North America: Exotic Animal Practice, 5, 49–81. https://doi.org/10.1067/mex.2002.10046-x.

Hutchinson, J. R., Rankin, J. W., Rubenson, J., Rosenbluth, K. H., Siston, R. A., & Delp S. L. (2015). Musculoskeletal modelling of an ostrich (Struthio camelus) pelvic limb: Influence of limb orientation on muscular capacity during locomotion. PeerJ, 3, e1001. https://doi.org/10.7717/peerj.1001.

Innes, J. (2016). Septic arthritis. In D. J. Griffon and A. Hamadeh (Eds.), Complications in small animal surgery (pp. 34–38). John Wiley & Sons.

Kestin, S. C., Knowles, T. G., Tinch, A. E., & Gregory, N. G. (1992). Prevalence of leg weakness in broiler chickens and its relationship with genotype. Veterinary Record, 131, 190–194. https://doi.org/10.1136/vr.131.19.190.

Knafo, S. E., Graham, J. E., & Barton, B. A. (2019). Intravenous and intraosseous regional limb perfusion of cefotiofur sodium in an avian model. American Journal of Veterinary Research, 80, 539–546. https://doi.org/10.2460/ajvr.80.6.539.

Marcon, A. V., De Oliveira, G. F., Caldara, F. R., Garcia, R. G., Matins, R. A., Marcon, A., Crone, C., & Assunção, A. S. A. (2019). Bacteriological and histopathological evaluation of articulations of chickens diagnosed with arthritis. Brazilian Journal of Poultry Science, 21, 2. https://doi.org/10.1590/1806-9061-2018-0805.

Mulon, P. Y., Desrochers, A., & Francoz, D. (2016). Surgical management of septic arthritis. Veterinary Clinics of North America. Food Animal Practice, 32, 777–795. https://doi.org/10.1016/j.vcf.2016.05.014.

Nairn, M. E. (1973). Bacterial osteomyelitis and synovitis of the turkey. Avian Diseases, 17, 504–517.

Ratliff, C. M., & Zaffarano, B. A. (2016). Therapeutic use of regional limb perfusion in a chicken. Journal of Avian Medicine and Surgery, 31, 29–32. https://doi.org/10.1647/2015-149.

Schaller, N. U., Herkner, B., Villa, R., & Aerts, P. (2009). The intertarsal joint of the ostrich (Struthio camelus): Anatomical examination and function of passive structures in locomotion. Journal of Anatomy, 214, 830–847. https://doi.org/10.1111/j.1469-7580.2009.01083.x.

Smith, F. M., West, N. H., & Jones, D. R. (1998). Renal portal system. In G. C. Whitlow (Ed.), Starke’s avian physiology (pp. 175–176). Academic Press.
Tully, T., Pechman, R., Cornick, J., & Morris, J. (1995). A subchondral cyst in the distal tibiotarsal bone of an Ostrich (Struthio camelus). Journal of Avian Medicine and Surgery, 9, 41–44.

Youssef, F. M., Soliman, A. A., Ibrahim, G. A., & Saleh, H. A. (2019). Advanced bacteriological studies on bumblefoot infections in broiler chicken with some clinicopathological alteration. Veterinary Science and Research, 1, 1–9.

How to cite this article: Peel, M. J., Torres, R. S. G., Ivančić, M., & Hernández, B. E. A. (2022). Management of intertarsal septic arthritis in an ostrich (Struthio camelus). Veterinary Medicine and Science, 8, 125–129. https://doi.org/10.1002/vms3.643