

3-2017

## Therapeutic Use of Regional Limb Perfusion in a Chicken

Cameron M. Ratliff  
*Iowa State University*

Bianca A. Zaffarano  
*Iowa State University, bazaff03@iastate.edu*

Follow this and additional works at: [https://lib.dr.iastate.edu/vcs\\_pubs](https://lib.dr.iastate.edu/vcs_pubs)



Part of the [Poultry or Avian Science Commons](#), and the [Veterinary Pathology and Pathobiology Commons](#)

The complete bibliographic information for this item can be found at [https://lib.dr.iastate.edu/vcs\\_pubs/38](https://lib.dr.iastate.edu/vcs_pubs/38). For information on how to cite this item, please visit <http://lib.dr.iastate.edu/howtocite.html>.

---

This Article is brought to you for free and open access by the Veterinary Clinical Sciences at Iowa State University Digital Repository. It has been accepted for inclusion in Veterinary Clinical Sciences Publications by an authorized administrator of Iowa State University Digital Repository. For more information, please contact [digirep@iastate.edu](mailto:digirep@iastate.edu).

---

## Therapeutic Use of Regional Limb Perfusion in a Chicken

### Abstract

A 2-year-old, 3.8-kg male Rhode Island red rooster was examined for lameness and progressive swelling of the right foot of several month's duration. Radiographs of the right foot demonstrated soft tissue swelling and a smoothly marginated periosteal reaction evident of inflammation affecting the bones. Results of a complete blood count showed a moderate leukocytosis and an elevated total protein concentration. Systemic antibiotic and anti-inflammatory therapy was started, but the bird had not improved at recheck examination. After intravenous catheterization of the medial metatarsal vein and placing a tourniquet at the femoral-tibiotarsal joint of the right leg, regional limb perfusion with amikacin and flunixin meglumine was performed. Dimensions of both feet were measured with digital calipers, and surface temperatures of the feet were measured with an infrared thermometer. The rooster had improved activity level with decrease in lameness and measurable decrease in swelling of the right foot. Regional limb perfusion with intravenous antibiotics and nonsteroidal anti-inflammatory drugs is a viable treatment modality in avian species for suspected distal limb infection and cellulitis. This technique has potential valuable implications for a variety of avian species. Fluid support should be provided if using nephrotoxic drugs.

### Keywords

cellulitis, tenosynovitis, regional limb perfusion, distal limb, avian, chicken

### Disciplines

Poultry or Avian Science | Veterinary Pathology and Pathobiology

### Comments

This article is published as Ratliff, Cameron M., and Bianca A. Zaffarano. "Therapeutic use of regional limb perfusion in a chicken." *Journal of Avian Medicine and Surgery* 31, no. 1 (2017): 29-32. DOI: [10.1647/2015-149](https://doi.org/10.1647/2015-149). Posted with permission.

## **Therapeutic Use of Regional Limb Perfusion in a Chicken**

Authors: Cameron M. Ratliff, and Bianca A. Zaffarano

Source: Journal of Avian Medicine and Surgery, 31(1) : 29-32

Published By: Association of Avian Veterinarians

URL: <https://doi.org/10.1647/2015-149>

---

BioOne Complete ([complete.BioOne.org](http://complete.BioOne.org)) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at [www.bioone.org/terms-o-use](http://www.bioone.org/terms-o-use).

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

---

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

## Therapeutic Use of Regional Limb Perfusion in a Chicken

Cameron M. Ratliff, DVM, and Bianca A. Zaffarano, DVM

**Abstract:** A 2-year-old, 3.8-kg male Rhode Island red rooster was examined for lameness and progressive swelling of the right foot of several month's duration. Radiographs of the right foot demonstrated soft tissue swelling and a smoothly marginated periosteal reaction evident of inflammation affecting the bones. Results of a complete blood count showed a moderate leukocytosis and an elevated total protein concentration. Systemic antibiotic and anti-inflammatory therapy was started, but the bird had not improved at recheck examination. After intravenous catheterization of the medial metatarsal vein and placing a tourniquet at the femoral-tibiotarsal joint of the right leg, regional limb perfusion with amikacin and flunixin meglumine was performed. Dimensions of both feet were measured with digital calipers, and surface temperatures of the feet were measured with an infrared thermometer. The rooster had improved activity level with decrease in lameness and measurable decrease in swelling of the right foot. Regional limb perfusion with intravenous antibiotics and nonsteroidal anti-inflammatory drugs is a viable treatment modality in avian species for suspected distal limb infection and cellulitis. This technique has potential valuable implications for a variety of avian species. Fluid support should be provided if using nephrotoxic drugs.

**Key words:** cellulitis, tenosynovitis, regional limb perfusion, distal limb, avian, chicken

### Clinical Report

A 2-year-old male Rhode Island red rooster was presented to the Iowa State University Lloyd Veterinary Medical Center for chronic swelling of the right foot of several month's duration. The rooster had been housed with 12 other hens in a backyard coop and was fed a diet of commercial layer ration pellets.

On examination, the chicken showed reluctance to ambulate, and the right foot was markedly swollen and warm to the touch (Fig 1). No external lesions were seen on any aspect of either foot. The rooster's body condition was adequate judging by keel musculature, and body weight was 3.8 kg. No other abnormalities were observed on physical examination.

Radiographs showed soft tissue swelling at the right distal tarsometatarsus and digits, with a smoothly marginated periosteal reaction primarily affecting the phalanges of digit 2, best seen on the dorsoplantar projection (Fig 2). Radiographic

findings were more consistent with cellulitis or deep pododermatitis, as opposed to osteomyelitis. Results of a complete blood count (CBC) and serum biochemical analysis showed leukocytosis ( $39.6 \times 10^3$  cells/ $\mu\text{L}$ ; reference interval,  $9\text{--}32 \times 10^3$  cells/ $\mu\text{L}$ )<sup>1</sup> with mature heterophilia and monocytosis and increased total protein (6.8 g/dL; reference interval, 3.3–5.5 g/dL).<sup>1</sup> All other blood test parameters were within reference intervals. A fine needle aspirate was taken from the plantar aspect of the right foot for cytologic analysis, which showed marked heterophilic inflammation, with no etiologic agents seen. On the basis of the inflammatory leukogram, the rooster was treated empirically with clindamycin (50 mg/kg PO q12h for 14 days) and meloxicam (2 mg/kg PO q24h for 14 days).

At a follow-up appointment 1 month later, the swelling of the right foot showed no improvement. The owner reported continued decreased activity and ambulation. After discussion of alternative treatment options, regional intravenous perfusion of antibiotics and anti-inflammatory medication into the right distal pelvic limb was elected by the owner.

---

From the Department of Veterinary Clinical Sciences, Lloyd Veterinary Medical Center, Iowa State University, College of Veterinary Medicine, Ames, IA 50011, USA.



**Figure 1.** A Rhode Island red rooster with a severely swollen right foot.

A complete physical examination was performed, with no abnormalities observed except for the previously described swollen right foot. Vital parameters were within reference limits. The chicken was observed standing and walking and exhibited marked lameness of the right foot. A blood sample was collected for measurement of uric acid concentration before therapy. External temperatures of the feet were taken with a digital infrared thermometer (Reptitemp, Zoo Med Laboratories, San Luis Obispo, CA, USA) 0.5 cm away from the skin surface at multiple locations, with the highest value being recorded for each foot (left foot = 38.3°C [101°F], right foot = 41.9°C [107.5°F]). A tourniquet was placed just proximal to the femoral-tibiotarsal joint of the right leg. The right medial metatarsal vein was catheterized with a 23-gauge butterfly catheter. Amikacin (5.3 mg/kg IV once) was injected intravenously through the butterfly catheter. The catheter was then flushed with 0.5 mL of heparinized saline before injection with flunixin meglumine (1.3 mg/kg IV once). After injections were completed, a timer was set for 15 minutes to mark when the tourniquet was to be removed. Medial-lateral and dorsal-plantar dimensions of the feet were measured with digital calipers (left foot = 25.1 × 21.0 mm, right foot = 38.7 × 37.7 mm), and the skin was marked at this location with a permanent marker for future reference. A warm, balanced electrolyte solution (32 mL/kg; Plasma-Lyte A, Abbott Laboratories, North Chicago, IL, USA) was delivered subcutaneously, evenly distributed between the right and left inguinal region. An additional 60 mL of warm tap water was gavaged orally into the crop with an 11-French red



**Figure 2.** Dorsoplantar radiographic view of right and left feet of a Rhode Island red rooster. The right foot shows moderate soft tissue swelling surrounding the distal tarsometatarsus and digits with a periosteal reaction. Joint spaces are unremarkable.

rubber catheter. The tourniquet was left in place for 15 minutes before removal. No further treatments or environmental changes were initiated, and the rooster was to be reevaluated in 2 weeks.

The rooster was seen for reevaluation 15 days later. The owner reported dramatic improvement in the rooster's mobility and noticeable decrease in swelling. The patient had gained 170 g in body weight from 15 days before. A blood sample was collected for a CBC and serum biochemical analysis from the right medial metatarsal vein. Total white blood cell (WBC) count had decreased from  $39.6 \times 10^3$  cells/ $\mu$ L before treatment to  $34.1 \times 10^3$  cells/ $\mu$ L, and total protein decreased from 6.8 to 6.0 g/dL after treatment. Surface temperatures of both feet were measured (left foot = 35.6°C [96°F], right foot = 38.6°C [101.5°F]) and compared with previous values. Dimensions of the feet were measured (left foot = 22.4 × 17.4 mm, right foot = 30.2 × 28.2 mm) and compared with previous values for the same location.

### Discussion

In this chicken, regional limb perfusion (RLP) was performed to treat lameness and distal limb swelling of an undiagnosed cause. After treatment, decreases were seen in the total WBC count, total protein concentration, surface temperature of the limbs, and swelling of the affected foot. RLP is a technique that is useful in treating distal limb infections because it allows for a high local

concentration of medications within deep tissues. This technique is used routinely in equine medicine,<sup>2-4</sup> but it has also been reported in various other species, including rabbits,<sup>5,6</sup> elephants,<sup>7</sup> wallaby, and kudu.<sup>8</sup> Indications for RLP range from osteomyelitis to cellulitis, septic arthritis, tenosynovitis, and sole abscesses. Amikacin is a commonly used antibiotic in RLP, with concurrent administration of anti-inflammatory drugs documented as well.<sup>9</sup>

To our knowledge, RLP has not been reported in an avian species. Aside from lack of familiarity with a technique that is more commonplace in large-animal medicine, RLP may be perceived as difficult to perform. Because venous access is necessary for RLP, it becomes technically difficult in smaller animals; however, it is feasible in birds as long as the medial metatarsal vein can be accessed for injection. Provided proper occlusion of vessels proximally, this technique could reasonably be considered for distal wing lesions through catheterization of the basilic vein.

Historically, the presence of a renal portal system in avian species has led to cautious use of potentially nephrotoxic drugs such as aminoglycosides and nonsteroidal anti-inflammatory drugs, particularly precluding administration of such drugs in the caudal half of the body where drugs are subject to first-pass through the kidneys.<sup>10</sup> However, debate is ongoing as to the significance of the presence of a renal portal system, especially in euhydrated animals.<sup>11,12</sup> Fluid support at daily maintenance volume was provided to ensure adequate hydration status and increase blood volume to minimize the effect of the renal portal system and the use of potentially nephrotoxic drugs.

Both amikacin and flunixin meglumine are considered nephrotoxic in avian species, but some species are more sensitive to adverse renal effects. Although less toxic than gentamicin, owing to its short half-life, amikacin, like other aminoglycosides, can still accumulate in the kidneys and cause renal damage.<sup>13</sup> Flunixin meglumine at a minimal dose was shown to cause glomerular lesions in northern bobwhite quail (*Colinus virginianus*), however, these birds were dehydrated and treated systemically for 7 consecutive days.<sup>14</sup> Even when administered together, the nephrotoxic effect of amikacin and flunixin meglumine may be mitigated by instituting fluid therapy and decreasing the dosing frequency. Amikacin and flunixin meglumine administration must be separated by complete flushing of the catheter fluid line, because the 2 drugs precipitate when combined.

Uric acid was measured as an indicator of renal function in this bird. Initial uric acid measured immediately before RLP was 4.5 mg/dL (reference interval, 2.5–8.1 mg/dL),<sup>1</sup> and at the 15-day recheck after a single RLP treatment, it was measured again at 2.0 mg/dL, so there was no detectable renal disease on the basis of this test. A normal level of serum uric acid does not exclude histopathologic changes in the kidneys, because severe renal compromise must be present to increase uric acid levels significantly.<sup>11</sup> Future studies aimed at establishing specific dosages for RLP should pair serial uric acid measurements with renal histopathologic findings in lieu of a more sensitive biomarker for avian renal function. Theoretically, the effect of potentially nephrotoxic drugs on the kidneys should be less with RLP than with systemic administration because RLP allows for a lower dose of aminoglycosides and nonsteroidal anti-inflammatory drugs while still achieving a higher tissue concentration at the target site. Future pharmacokinetic and safety data need to be accumulated to derive proper dosages for RLP, whether in chickens or in other avian species.

Bacterial culture and susceptibility testing was not performed before treatment with RLP. In horses, inference of septic arthritis has been made based on clinical findings and cytologic evidence of inflammation.<sup>15</sup> Despite finding no causative agent on cytologic examination, empirical treatment with an oral antibiotic and nonsteroidal anti-inflammatory drug was initiated, and no clinical improvement was seen. Because of the possibility of an infection affecting deep tissues and synovial structures, RLP was chosen to achieve high drug concentrations in these poorly perfused areas.<sup>16</sup> Sampling of the deeper tissues of the right foot for bacterial culture was not attempted for fear of damaging synovial structures or introducing bacteria into a currently nonseptic joint. Furthermore, cultures are often negative, and negative results would not eliminate the possibility of infection.<sup>17</sup> *Staphylococcus* species of bacteria are commonly implicated in cases of arthritis and tenosynovitis in poultry; however, this is difficult to sample and culture reliably, because routine aerobic culture of joints experimentally injected with *Staphylococcus* species in dogs was shown to have false negative rates greater than 50% of the time.<sup>17</sup> *Mycoplasma synoviae*, another organism that can cause infection and swelling of distal limbs in avian species, is difficult to culture without the use of special growth media.

As popularity of backyard poultry increases, RLP may potentially emerge as a viable option in

treating distal limb morbidities, including difficult to treat cases of deep pododermatitis or osteomyelitis. When used in tandem with fluid support, RLP should be considered an option for unresolved distal limb infections in any avian species where venous access is available. Further controlled studies with a larger sample size including different avian species are warranted.

*Acknowledgments:* We thank Harrison's Bird Foods Inc for funding this case.

### References

- Hawkins MG, Barron HW, Speer BL, et al. Birds. In: Carpenter JW, ed. *Exotic Animal Formulary*. 4th ed. St Louis, MO: Saunders/Elsevier; 2013:347.
- Rubio-Martinez LM, Cruz AM. Antimicrobial regional limb perfusion in horses. *J Am Vet Med Assoc*. 2006;228(5):706–712.
- Rubio-Martinez LM, Elmas CR, Black B. Clinical use of antimicrobial regional limb perfusion in horses: 174 cases (1999–2009). *J Am Vet Med Assoc*. 2012;241(12):1650–1658.
- Murphey ED, Santschi EM, Papich MG. Regional intravenous perfusion of the distal limb of horses with amikacin sulfate. *J Vet Pharmacol Ther*. 1999; 22(1):68–71.
- Finsterbusch A, Argaman M, Sacks T. Bone and joint perfusion with antibiotics in the treatment of experimental staphylococcal infection in rabbits. *J Bone Joint Surg Am*. 1970;52(7):1424–1432.
- Finsterbusch A, Weinburg H. Venous perfusion of the limb with antibiotics for osteomyelitis and other chronic infections. *J Bone Joint Surg*. 1972;54(6): 1227–1234.
- Ollivet-Courtois F, Lecu A, Yates RA, et al. Treatment of a sole abscess in an Asian elephant (*Elephas maximus*) using regional digital intravenous perfusion. *J Zoo Wildl Med*. 2003;34(3):292–295.
- Fiorello CV, Beagley J, Citino SB. Antibiotic intravenous regional perfusion for successful resolution of distal limb infections: two cases. *J Zoo Wildl Med*. 2008;39(3):438–444.
- Cimetti LJ, Merriam JG, D'Oench SN. How to perform intravenous regional limb perfusion using amikacin and DMSO. *Proc 50th Annu Conf Am Assoc Equine Pract*. 2004:14–29.
- Smith FM, West NH, Jones DR. Renal portal system. In: Whittow GC, ed. *Sturkie's Avian Physiology*. 5th ed. San Diego, CA: Academic Press; 1998:175–176.
- Burgos-Rodriguez, AG. Avian renal system: clinical implications. *Vet Clin North Am Exot Anim Pract*. 2010;13(3):393–411.
- Frazier DL, Jones MP, Orosz SE. Pharmacokinetic considerations of the renal system in birds: part I. Anatomic and physiologic principles of allometric scaling. *J Avian Med Surg*. 1995;9(2):92–103.
- Frazier DL, Jones MP, Orosz SE. Pharmacokinetic considerations of the renal system in birds: part II. Review of drugs excreted by renal pathways. *J Avian Med Surg*. 1995;9(2):104–121.
- Klein PN, Charmatz K, Langenberg J. The effect of flunixin meglumine (Banamine) on the renal function in northern bobwhite quail (*Colinus virginianus*): an avian model. *Proc Annu Conf Assoc Avian Vet*. 1994:128–131.
- Kraus BM. Lacerations involving synovial structures: initial treatment and novel therapy for infectious arthritis/tenosynovitis. *Clin Tech Equine Pract*. 2006;5(2):82–92.
- Lugo J, Gaughan EM. Septic arthritis, tenosynovitis, and infections of hoof structures. *Vet Clin North Am Equine Pract*. 2006;22(2):363–388.
- Montgomery RD, Long IR, Milton JL, et al. Comparison of aerobic culturette, synovial membrane biopsy, and blood culture medium in detection of canine bacterial arthritis. *Vet Surg*. 1989; 18(4):300–303.