

How to Perform Regional Limb Perfusion in the Standing Horse

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Regional limb perfusion is a practical and effective adjunctive therapy for treatment of septic conditions of the equine extremity. Regional limb perfusion can be performed easily in the standing horse using sedation and regional anesthesia. Authors' address: New Jersey Equine Clinic, 279 Millstone Rd., Clarksburg, NJ 08510. © 1999 AAEP.

1. Introduction

Infection of the synovial structures of the equine extremity is a common complication of lacerations and athletic injuries of the horse. Iatrogenic infection of the carpus, tarsus, metacarpal/metatarsal-phalangeal joints and distal interphalangeal joint subsequent to intra-articular injection often are career-ending or life-threatening. Regional limb perfusion by intramedullary administration of gentamicin into the radius of experimental horses under general anesthesia produced high concentrations of gentamicin within the synovial fluid of the antebrachiocarpal joint.¹ Another experimental study in anesthetized horses showed that IV digital perfusion with amikacin resulted in synovial fluid concentrations 25 to 50 times the minimum inhibitory concentration required to kill most pathogenic bacteria.² Regional limb perfusion with antibiotics that have efficacy against common equine orthopedic pathogens has been shown to be an effective adjunctive means of treatment of septic conditions of the equine extremity.^{3,4} In previous experimental studies and clinical reports, IV digital perfusion was performed in horses placed under general anesthesia and positioned in lateral recumbency.¹⁻⁴ In one

report, the authors state that intravascular perfusion can be performed in the standing horse but that the effect of weight bearing on the concentration of drug achieved is unknown.⁴

This report presents a practical technique for regional limb perfusion in the standing horse, eliminating the need for general anesthesia in many cases and providing a practical means of repeated follow-up treatment in horses that require anesthetic procedures for initial treatment of a septic condition.

2. Materials and Methods

In the first part of this study, a 3-year-old Thoroughbred filly with no clinical signs of lameness or orthopedic disease was used to document the vascular-occlusive effects of an Esmarch bandage applied to the metacarpus and to demonstrate the ability of IV digital perfusion to perfuse tissues of the extremity adequately in a standing horse. With the filly sedated with a combination of 15 mg of acepromazine maleate and 5 mg of detomidine hydrochloride, the right forelimb was aseptically prepared from the metacarpus to the hoof wall, and a high palmar nerve block was performed. Two 4 × 4 gauze sponges were rolled into cylinders and taped over the

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digital vessels at the junction of the proximal and middle metacarpus. An Esmarch bandage was then applied to the limb and tightened over the gauze pads. A 20-gauge catheter^a with an injection port^b was placed into the lateral digital vein immediately proximal to the lateral proximal sesamoid bone and taped in place (Fig. 1). Forty milliliters of Renografin-76^c was injected into the digital vein through the catheter. Dorsopalmar and lateromedial xeroradiographic views were obtained before injection and at 10 seconds, 15 minutes and 30 minutes after injection of the dye. After 30 minutes, the Esmarch bandage was removed. A final set of xeroradiographs was obtained 15 minutes after removal of the tourniquet (45 minutes after dye injection).

In the second phase of this study, the medical records of 24 horses with septic conditions of the extremity treated with regional limb perfusion at the New Jersey Equine Clinic between October 1995 and March 1999 were reviewed. The case population included 9 Thoroughbreds and 15 Standardbreds ranging in age from 3 months to 8 years. Except for 1 foal, all horses in this group were in active race training at the time of admission. Fifteen of these horses were presented for treatment of septic arthritis secondary to intra-articular injection, 5 horses were presented for treatment of septic tenosynovitis of the digital sheath, and 4 horses were presented for treatment of osteomyelitis.

In all cases, the horses in the study were treated with IV regional limb perfusion in conjunction with systemic and local antimicrobial therapy and non-steroidal anti-inflammatory therapy. In many cases of intra-articular infection, arthroscopy was used to debride the synovium and lavage the joint. In cases of tenosynovitis, the tendon sheath was lavaged through multiple stab incisions, or tenoscopy was used to debride and lavage the tendon sheath. In horses undergoing arthroscopy or tenoscopy, regional limb perfusion initially was performed in conjunction with those procedures, with horses under general anesthesia. After arthroscopic or tenoscopic procedures, the instrument portals were usually left open to provide for repeated postoperative lavage.

Otherwise, regional limb perfusion was performed in these horses using regional anesthesia and a standing technique. The perfusions were performed either as single treatments or as series of up to four treatments, according to the clinical progress of each horse. In one case of carpal joint involvement, the cephalic vein was used for perfusion in conjunction with median, ulnar and musculocutaneous nerve blocks and a tourniquet placed proximal to the carpus. In one case of tarsometatarsal joint infection, the saphenous vein was catheterized and used for perfusion of antibiotics in conjunction with tibial and peroneal nerve blocks and a tourniquet placed proximal to the tarsus. The palmar digital vein was catheterized for treatment of septic conditions involving the metacarpal/metatarsal-

phalangeal joint or the distal interphalangeal joints in conjunction with high palmar nerve block and a tourniquet placed proximal to the metacarpal/metatarsal-phalangeal joint. A new catheter was used for each treatment. In this group of horses, regional limb perfusion was performed using 1 g of amikacin, 1 g of timentin, 10 million IU of potassium penicillin or 1 g of gentamicin diluted to a volume of 20 ml with normal saline. In some cases, amikacin and timentin were used together for the perfusion. Selection of the antibiotic was based on bacterial culture and sensitivity testing.

3. Results

In the first part of this study, xeroradiographic assessment of IV digital perfusion confirmed complete perfusion of the digital vasculature with radiopaque dye within seconds of injection (Fig. 2). Fifteen minutes after injection, the dye had begun leaving the vascular space and diffusing into the perivascular tissues (Fig. 3). Thirty minutes after injection, even less dye was visible in the vascular space as the dye continued to accumulate in the soft tissues of the digit (Fig. 4). Fifteen minutes after tourniquet removal, the dye was no longer visible in the vascular space, but residual soft tissue uptake of the dye remained visible.

In the second part of this study, the overall survival rate of horses treated with regional limb perfusion as an adjunctive treatment for septic conditions of the extremity was 75% (18 of 24). No adverse reactions or complications related to regional limb perfusion were observed in any of these horses. Euthanasia was performed in 6 cases because of failure to eliminate the infection or persistent lameness resulting from the sequelae of the infection.

Staphylococcus aureus was isolated from 12 of 24 horses; 3 of these isolates were methacillin-resistant organisms. *Streptococcus* species were isolated from 4 horses, and *Escherichia coli* was isolated from 3 horses. *Klebsiella*, *Enterobacter* and *Proteus mirabilis* were each isolated from 1 horse. In 2 horses that were previously treated with antibiotics, no organisms could be isolated from synovial fluid samples obtained at the time of admission to the referral hospital.

Of the 18 surviving horses, 5 horses were able to resume successful racing careers, 6 were retired from racing for less demanding athletic careers and 7 were pasture sound.

4. Discussion

The positive-contrast dye study performed in the experimental horse documented the effectiveness of an Esmarch bandage to restrict venous return from the equine digit without use of a pneumatic tourniquet and demonstrated the ability of a digital IV injection to perfuse the soft tissues of the digit of a standing horse adequately within minutes after injection.

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Fig. 1. With an Esmarch bandage used to restrict venous return from the extremity, a 20-gauge flexible catheter is placed into the palmar digital vein for infusion of the antibiotic solution in a standing horse.

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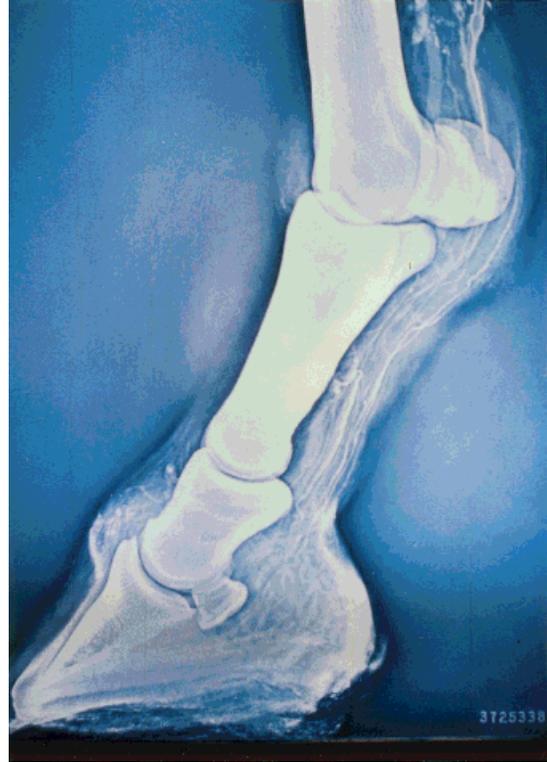


Fig. 3. Lateral-to-medial xeroradiograph taken of the digit 15 minutes after injection of the radiopaque dye. The dye is seen leaving the vascular space and diffusing into the adjacent soft tissues.

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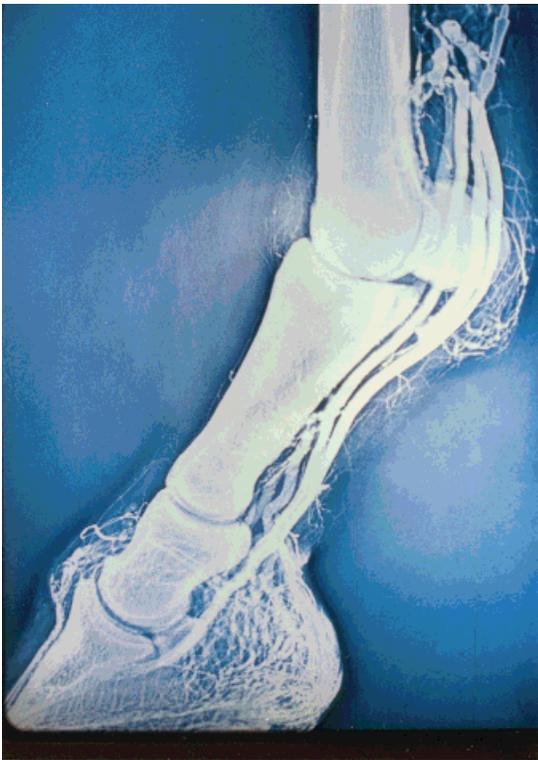


Fig. 2. Lateral-to-medial xeroradiograph taken of the digit approximately 10 seconds after injection of 40 ml of Renograffin-76 into the palmar digital vein of a standing horse. Note complete perfusion of both the venous and arterial vascular spaces.

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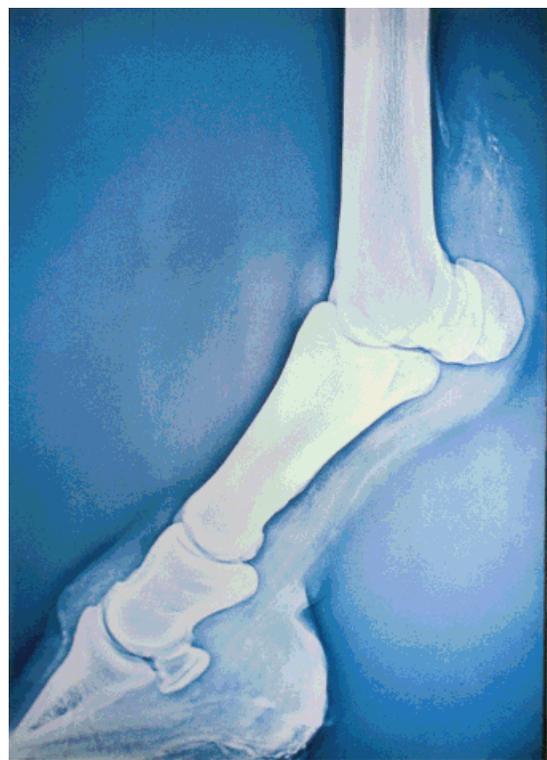


Fig. 4. Lateral-to-medial xeroradiograph taken of the digit 30 minutes after injection of the radiopaque dye. Most of the dye has left the vascular space and is now completely distributed within the soft tissues of the digit.

The retrospective portion of this study confirmed reports of others that regional limb perfusion can be a useful adjunctive therapy for treatment of septic conditions of the equine extremity.^{3,4} The survival rate of the horses in this study was similar to that reported in previous studies for treatment of septic conditions of the extremity.^{4,5} *Staphylococcus* was the most common bacteria isolated from the synovial fluid of this group of horses. Treatment of the methacillin-resistant *Staphylococcus* organisms with enrofloxacin^d (5 mg/kg PO q 24 h) was successful in a number of cases.

Regional limb perfusion through superficial veins of equine extremities requires no special equipment or technical training, delivers concentrations of antibiotics that exceed accepted therapeutic levels to synovial tissues and is easily accomplished in standing horses. For these reasons, equine practitioners should consider regional limb perfusion as a practical adjunctive treatment for septic conditions of the equine extremity.

References and Footnotes

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5. Schneider RK, Bramlage LR, Moore RM, et al. A retrospective study of 192 horses affected with septic arthritis/tenosynovitis. *Equine Vet J* 1992;24:436–442.

^aAbbotath®-T, 20G × 32 mm, A&G Pharmaceuticals, Clarksburg, NJ 08510.

^bSurflo® Injection Plug, Terumo Medical Corp, Elkton, MD 21921.

^cRenograffin-76®, Solvay Animal Health, Inc., Mendota Heights, MN 5120.

^dBaytril®, Bayer Corporation, Agriculture Division, Animal Health, Shawnee Mission, KS 66201.