
Kirsten M. Neil, BVSc, MS, Diplomate ACVIM; Jane E. Axon, BVSc, Diplomate ACVIM; Angela P. Begg, BVSc, PhD; Paddy G. Todhunter, BVSc, MS, Diplomate ACVS; Paul L. Adams, BVSc; Amanda E. Fine, VMD, MS; John P. Caron, DVM, MVSc, Diplomate ACVS; and Angus R. Adkins, BVSc

With early diagnosis and appropriate treatment, the prognosis for the survival of foals with septic osteomyelitis is favorable. Age at recognition, multisystem disease involvement, and multiple bone or joint involvement are important prognostic indicators; however, the location of lesions also seems to influence the prognosis. Authors’ addresses: Goulburn Valley Highway, 905 Goulburn Valley Highway, Congupna, Australia 3633 (Neil); Scone Veterinary Hospital, 106 Liverpool Street, Scone, New South Wales, Australia 2337 (Axon, Begg, Todhunter, Adams, Adkins); and Department of Large Animal Clinical Sciences, College of Veterinary Medicine, Michigan State University, East Lansing, MI 48824 (Fine, Caron); e-mail: neilkirsten@hotmail.com (Neil). © 2006 AAEP.

1. Introduction
Osteomyelitis, often associated with septic arthritis, is a serious orthopedic condition of foals. Hematogenous dissemination of bacteria to bone is the most common cause. Previous studies have reported the survival of foals with osteomyelitis and/or septic arthritis to be less than that of septic foals without bone or joint involvement. In addition, the subsequent athletic performance of such foals is substantially less than that of unaffected foals. Despite the prevalence of bone lesions, variables of prognostic value in foals with septic osteomyelitis have received less attention.

The objective of this study was to evaluate the clinical, laboratory, and radiographic findings of foals with septic osteomyelitis and to evaluate factors affecting the short-term survival and future athletic performance of affected foals.

2. Materials and Methods
The medical records of Thoroughbred foals <6 mo of age that were treated for septic osteomyelitis at Scone Veterinary Hospital, New South Wales, Australia between August 1995 and December 2001 were reviewed. Foals included in the study had radiographic evidence of osteomyelitis and one or more of the following supportive clinical and laboratory findings: lameness or altered gait, pain on palpation of the affected area, improvement or resolution of lameness with perineural analgesia, increased white blood cell (WBC), absolute neutrophil, or band neutrophil count, increased fibrinogen con-
centration, and/or positive microbial culture from bone. Foals with osteomyelitis secondary to penetrating wounds or surgery and foals with septic arthritis without evidence of bone involvement were excluded from the study.

Short-term survival was defined as the successful discharge of the foal from the hospital. Race records were obtained for foals that reached racing age (>2 yr old) at the time of the study. Several statistical comparisons were performed. A two-sample t-test was used to test for significant differences in the means of continuous variables grouped by outcome of interest. The Pearson’s χ² and Mantel-Haenszel χ² tests were used to test for significant associations between discrete dependent variables and outcomes of interest and to generate an estimation of the odds ratio (OR) with a 95% CI. The p value for the Fisher’s Exact test was used when one cell in a 2 × 2 table contained a value <5.

3. Results
One hundred eight Thoroughbred foals met the inclusion criteria. Mean age of foals at admission was 39 days (range = 1–180 days). Sixty foals were <30 days of age at the time of development of bone lesions. Sixty-one foals were male, forty foals were female, and seven foals did not have their sex recorded. Eighty-eight foals presented with lameness or altered gait associated with pain on palpation of the physis/bone and/or synovial effusion as the primary complaint. The remainder of foals developed bone lesions during or after treatment for other clinical problems.

In total, 141 bone lesions were documented. The femur (20.6%), distal phalanx (17.7%), and tibia (17%) were the most commonly affected sites. Less frequently affected were the third metacarpal/metatarsal bone (9%), radius (7%), proximal sesamoid bones (5%), tarsal bones (5%), and tuber calcaneus (5%). Other affected bones included the ulna, carpal bones, navicular, proximal phalanx, middle phalanx, humerus, scapula, patella, and ilium.

Twenty-one foals had >1 bone affected (range = 2–6 bones). Seventy-six foals had concurrent septic arthritis, of which sixteen had multiple joints affected (range = 2–6 joints). In 71 foals, osteomyelitis or osteitis affected bones adjacent to the septic joint, and nine of these foals had additional distant septic joints. Five foals had septic arthritis in joints distant to the site of osteomyelitis.

Results of bacterial culture of bone, available for 15 foals, yielded 66% positive results. Synovial-fluid culture results were available for 67 foals, of which 52% were positive. Escherichia coli was frequently isolated from bone, and Streptococcus spp. was frequently isolated from synovial fluid.

Overall, 87 foals (80.6%) survived to discharge from hospital. Euthanasia was performed in 20 foals because of failure to respond to treatment. One foal died because of complications related to septicemia.

After discharge, seven foals died or were euthanized before they were 1 yr of age: five from unrelated causes, and two by progression of osteomyelitis after discharge.

Foals with multiple bone involvement were significantly less likely to be discharged from the hospital (OR = 0.29; 95% CI = 0.09–0.82; p = 0.016). There was a trend toward a less favorable prognosis for foals with concurrent septic arthritis, and foals with multiple septic joints were significantly less likely to be discharged from the hospital (OR = 0.12; 95% CI = 0.036–0.37; p < 0.0001). As the number of either septic joints or bones increased, prognosis for survival to discharge decreased significantly (p = 0.004). Foals that did not survive to be discharged from the hospital were significantly more likely to be critically ill neonates (OR = 0.06; 95% CI = 0.01–0.32; p < 0.0001), have multisystem disease (OR = 0.25; 95% CI = 0.001–0.67; p = 0.004), and be <30 days of age at the time of development of bone lesions (OR = 0.23; 95% CI = 0.07–0.74; p = 0.0091).

Seventy-nine foals had long-term survival after discharge, and 52 of these foals raced (52 of 79 foals, 65.8%). Forty-eight had official race starts, and four had unofficial race starts. Foals that did not race were significantly more likely to have multiple septic joints (p = 0.04). When foals reached race age, multiple bone lesions did not significantly influence ability to race.

4. Discussion
The prognosis for the survival and subsequent performance of foals with septic arthritis/osteomyelitis has been reported as guarded to grave. The survival rate in this study was equal to or higher than those in previous reports; however, those studies included foals presenting septic arthritis without bone involvement, which were omitted from this study. In this study, age at diagnosis, multisystem disease, and concurrent septic arthritis all influenced prognosis for survival.

Site(s) of osteomyelitis have been previously reported. In one study, the third metacarpal bone was the most frequently affected bone followed by the tibia and femur. The femur was the most frequently affected bone in another study, and a different report documented the predominance of affected bone in all three sites. In this study, the bones most frequently affected were the femur, tibia, and distal phalanx followed by the third metacarpal/metatarsal bones. All foals with lesions of the tuber calcaneus, patella, ilium, and scapula survived to be discharged, and foals with lesions of the distal phalanx, proximal sesamoid, tibia, third metacarpal/metatarsal, and femur also had favorable outcomes. Foals with lesions of the proximal phalanx, radius, humerus, and tarsal bones (excluding tuber calcaneus) had poorer outcomes.

Age was significantly correlated with the short-term survival of affected foals: foals <30 days of age at the time of development of bone lesions were
significantly less likely to be discharged from the hospital. This was attributed to the high incidence of multisystem disease (50%), failure of passive transfer (50%), and multiple affected bones (50%) or joints (55%) in foals in this age group, which was consistent with previous findings of negative prognostic indicators for septic arthritis.2,7

It has been reported that the presence of multiple sites of osteomyelitis warrants a poor prognosis.11 In this study, multiple bone involvement influenced short-term survival but did not influence prognosis for racing. However, the involvement of multiple joints did have a significant impact on both short-term survival and future racing performance, because the likelihood of survival to discharge was influenced by the number of joints affected. This has been observed in a number of studies on septicemia and septic arthritis in foals.5,7,9 Although there was no association in one recent study,8 this study included only 7% of foals with multiple joint involvement.

In conclusion, our results suggest that foals with osteomyelitis may warrant a more favorable prognosis than has been described previously. Multisystem disease, age, and multiple sites of infection all have a negative influence on the short-term survival. However, surviving foals have a good chance of reaching the track and racing.

References and Footnotes

*aAustralian Associated Press Racing Information Services, Sydney, New South Wales, 2052 Australia.