



CASE REPORT: CLINICAL, RADIOGRAPHIC AND SCINTIGRAPHIC EVALUATION OF A HORSE WITH CHRONIC DISTAL LIMB ARTHRITIS AND NAVICULAR BONE FRACTURE BEFORE AND AFTER RADIAL EXTRACORPOREAL SHOCK WAVE THERAPY (ESWT).

INTRODUCTION

ESWT has recently been used to treat numerous orthopedic injuries in horses. Previous research suggests that ESWT has analgesic properties and enhances bone remodeling.(footnote 1-3) A debate exists regarding whether or not radial ESWT treatment affects bone metabolism or whether the effects are strictly analgesic. The effect of ESWT as reflected by nuclear scintigraphy, (and thus bone metabolism), is not intuitively obvious. The objective of this case study is to review the effect of radial ESWT treatment on a horse with chronic distal limb arthritis and a navicular bone fracture. Additional case studies involving focused and non-focused ESWT will be discussed.

MATERIALS AND METHODS

A 13 year TB gelding was presented with a history of chronic foot lameness secondary to distal interphalangeal osteoarthritis and navicular bone degeneration. Subsequently, a palmar digital neurectomy was performed and the horse successfully returned to hunter-jumper competitions. Approximately 6 months post surgery the horse became non weight-bearing lame in the affected leg. Radiology confirmed a navicular bone fracture. The horse was box stall rested for 4 months before returning to restricted turnout management. Following two months of restricted pasture rest, the horse remained grade 3/5 lame, (AAEP scale). The following evaluation was conducted approximately 1 year following the initial navicularbone fracture. Prior to the study, the horse had been consistently grade 3/5 lame for 8 months.

The initial examination consisted of a routine lameness examination, flexion test, and observation in a straight line and circle on a firm surface. Palmar digital anesthesia had a minimal impact on the lameness, (neurectomy), and an abaxial sesamoid nerve block abolished the lameness completely. A 7-view radiographic study was made of the effected region.

First Bone scan: Scintigraphy was performed utilizing 150 millicuries of technetium 99m MDP, administered intravenously 2 hours before the scan. Immediately prior to scintigraphy, Detomidine HCL was administered (0.002mg/Kg intravenously). In an effort to maintain consistency between images, exposure rates were kept constant;100,000 counts were taken on all lateral views, 50,000 counts were taken on all solar views, and 150,000 counts were taken on all Dorsopalmar views.



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Immediately following the initial bone scan, the fractured navicular bone was treated with ESWT. No additional anesthesia was required for treatment. The Swiss DolorClast® Vet (EMS Corp. USA, Dallas, TX, www.ems-medicalamerica.com) Extracorporeal shockwave therapy system was used and 2,000 shocks were administered between the heel bulbs of the affected limb over 5 minutes.

Second bone scan: Following ESWT treatment, the horse was stabled for 4 hours before repeat scintigraphic images were obtained, (no additional isotope). Following scintigraphy, 2,000 shock waves were administered regionally to the dorsal aspect of the pastern and proximal coffin bone. All further treatments were administered to the heel bulbs as well as to the dorsal aspect of the distal limb.

Follow up examinations and ESWT treatments were conducted at 14-day intervals for three treatments.

Third bone scan: The final evaluation was conducted 30 days after the final treatment, (approximately 9 weeks after the first visit). The final evaluation included "follow up" clinical evaluation, radiology and scintigraphy.

RESULTS

Radiographic findings;

Initial radiographs identified the navicular bone fracture and degeneration. Bony proliferations and osteophytes are evident along the dorsal border of the second phalanx. Soft tissue calcifications are present in the soft tissue structures of the palmar pastern. Minimal radiographic changes were noted when the initial and final radiographs were compared.

Scintigraphic findings;

First bone scan: The initial scintigraphic study revealed moderate focal increased radiopharmaceutical uptake along the dorsal border of the first and second phalanx. A moderate focal increased uptake was present over the navicular bone as well as over the structures immediately proximal to the navicular bone. The dorsopalmar view reveals a moderate diffuse increased uptake of the entire limb distal of the first phalanx. The solar aspect of the affected foot reveal mild/moderate focal increased uptake corresponding with site of the navicular fracture.

Second bone scan: Scintigraphic images taken 4 hours after the first ESWT treatment reveal a mild focal increased uptake on the navicular region when compared to the imaged take immediately before treatment.

Final bone scan: The final bone scan is compared to the initial bone scan. The scintigraphic study obtained 4 weeks following the final ESWT treatment revealed a



marked decreased regional uptake of the distal limb on the dorsopalmar view. Additionally, a mild/moderate decreased uptake of radiopharmaceutical was seen on the dorsal aspect of the second and third phalanx on the lateromedial projection. Similarly, a mild decrease in uptake of radiopharmaceutical was seen of the palmar structures immediately proximal to and including the navicular bone.

Clinical response as evidenced by reduction in lameness scores was apparent. At the first follow-up visit, (after one treatment), the lameness score decreased from grade 3/5 to grade 2/5. During the second and third follow up visits, no significant change was noted. During the final visit, the lameness showed a mild additional improvement, (not a full grade). No associated complications from treatments were detected during the study.

DISCUSSION

ESWT is a relatively new method of treating orthopedic injuries in horses. The Swiss DolorClast[®] Vet system utilizes pneumatically generated shock waves which are emitted in a radial pattern, (versus focused shockwaves). At the present time, a debate exists about the mechanism of action of radial pressure wave therapy. It is thought that an initial transient analgesic effect is produced by the Swiss DolorClast[®] Vet system. Additionally, repeated ESWT treatments have been shown to stimulate bone remodeling. (footnote 1)

Nuclear scintigraphy is an accepted method of evaluating skeletal mineral metabolism and physiologic conditions in horses. (footnote 4) Typical scintigraphic equipment is capable of measuring as little as 10 exponent -13g of radiopharmaceutical. (footnote 5) Areas of increased "turn over" of the inorganic components of hydroxyapatite in the bone tissue are apparent as areas of increased radiopharmaceutical uptake on the scintigraph. In layman's terms, the increased radiopharmaceutical uptake is termed a "hot spot", and is viewed as a dark area on the scintigraph. As stated above, scintigraphy is an extremely sensitive measurement of bone metabolism. Thus, scintigraphy is a valuable tool to monitor physiologic response to ESWT.

However, variations in the rate of tissue repair can occur amongst individual horses. Therefore, caution must be used in determining the significance of a given area of activity. The areas of increased radiopharmaceutical uptake on the first scintigraphic study appear to correlate with the radiographic abnormalities noted. This correlation suggests that the scintigraphic changes depicted are significant in this case.

At the present time, no published information is available regarding scintigraphic response to ESWT. Numerous studies have been published which describe a favorable clinical response to ESWT. Because of the multifactorial nature of the lameness in this patient, it is impossible to attribute the favorable *clinical response* seen in this case to *analgesia* or *enhanced healing* of any specific anatomical structure. Nonetheless, it



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should be noted that the lameness score had been grade 3/5 for approximately 8 months prior to the study. A reduction in lameness was seen following the treatment protocol from grade 3/5 to grade 2/5.

The patient in this study was selected because of the chronic nature of the injuries. Whereas a patient with an acute trauma may naturally experience dramatic physiological changes shortly after the injury, this patient had sustained the navicular bone fracture over one year prior to the study. Additionally, the osteoarthritis present in the distal interphalangeal joint was present for at least one year prior to the navicular bone fracture. Although tissue remodeling is likely to persist indefinitely with either injury, the scintigraphic changes seen over the nine-week period of the study are unlikely to be a coincidental finding.

When comparing the first scintigrams to those obtained approximately 4 hours after the ESWT treatment of the navicular bone, (on the same day), a subtle increased radiopharmaceutical uptake is present in the navicular area following ESWT treatment. This increase may be attributed to abnormal redistribution of isotope in the area of the fracture, or may have been a response to the ESWT treatment.

When comparing the initial scintigrams to the final scintigrams, a number of observations are made. The most obvious change is apparent on the dorsopalmar view where a reduction of radiopharmaceutical uptake is apparent regionally. On the final lateromedial view, a focal reduction of radiopharmaceutical is apparent along the dorsal margins of the middle and distal interphalangeal joints. A mild focal reduction of uptake is evident over the navicular bone and adjacent structures in the final lateromedial scintigrams. Comparison of the first and last scintigrams taken of the sole of the hoof reveals a mild focal reduction of uptake over the fracture site.

Extracorporeal Shock Wave Therapy is a promising and relatively new method of treating numerous orthopedic injuries in horses. However, fundamental questions regarding the mechanism of action remain unanswered. This case study was designed to evaluate the scintigraphic, (and thus physiologic), response of one horse to ESWT therapy. The results of this case study suggest that radial ESWT treatments to the distal limb may effect bone metabolism and enhance the rate of bone healing. Further research with larger numbers of patients is needed to confirm the significance of this case study.

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AUTHOR

Mark S. Revenaugh DVM

Furlong and Associates Veterinary Clinic

PO Box 16

Oldwick, NJ 08858

Tel (908) 439-2821

Fax (908) 439-2691

Email revenaugh@aol.com

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