Valgus in the Foal

A Case Report

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INTRODUCTION

Angular limb deformities are a common occurrence in the equine species and are mostly noted in foals. There are multiple varieties of angular limb deformities; however, the most common type is carpal valgus (4). Valgus is an angular limb deformity that is generally considered either a developmental orthopedic disease or a perinatal disease (2). With valgus deformity the limb deviates laterally, and distally to a reference point, which is usually a joint (3). Treatment is based on etiology, location, and severity of the deformity, and it is time sensitive in most cases. Prognosis also depends on the etiology, location, and severity of the deformity; however, if treated appropriately and in a timely manner, prognosis is usually good.

HISTORY AND PRESENTATION

Ranger White presented to his referring veterinarian on June 6, 2016, 3 days after his birth. Ranger was diagnosed with bilateral carpal valgus with “over at the knee” conformation (flexural limb contracture) at this appointment. Strict stall confinement was advised for Ranger, and re-evaluation was to take place 5-6 days later. Upon reevaluation Ranger had improved slightly; however, it was recommended that Ranger visit MSU-CVM for further consultation and evaluation.

Ranger presented to the Mississippi State College of Veterinary Medicine Equine service on July 14, 2016. At initial presentation to MSU-CVM Ranger was 11 days old, and angular limb deformities in his forelimbs were evident bilaterally. Radiographs were taken of both his right and left forelimbs, specifically the carpi, radii, and ulnas. The radiographs of his carpal bones showed appropriate ossification for his age. The lateral aspect of his distal radial epiphysis proved shorter than the medial aspect in both forelimbs and was therefore considered to be the center of his carpal valgus deformity. In addition, when viewed from a lateral to medial projection both radii were bowed in the cranial-caudal plane. This was the cause of Ranger's "over at the knee" conformation in both forelimbs.

Recommendations were made to the owner that Ranger should remain stall confined until a follow-up appointment which was scheduled for August 1, 2016. It was conferred with the owners that Ranger would most likely need to be scheduled for reparative surgery should he return with the deformities still present. When Ranger returned on August 1st his bilateral carpal valgus was still present. Surgical treatment was scheduled for the following day, August 2, 2016.

PATHOPHYSIOLOGY/ANATOMICAL CONSIDERATIONS

Common angular limb deformities seen in foals are fetlock varus, tarsal varus, and carpal valgus, which is the most common (4). Ranger's deformity was considered carpal valgus because his limbs deviated distally to his carpi, laterally, giving him a "splay-footed" appearance.

Valgus, as well as other angular limb deformities, can be considered acquired or congenital and are usually influenced by perinatal or developmental factors (4). Some perinatal factors that contribute to angular limb deformities in foals are as follows: cuboidal bone hypoplasia, laxity and weakness of periarticular structures, and rotational deformities. Developmental etiologies range from unbalanced nutrition, excessive exercise or trauma, and bone dysplasia (7).

Cuboidal bone hypoplasia is considered a perinatal factor of angular limb deformities and is defined as: insufficient ossification of the small carpal and tarsal bones. Radiographs of these bones reveal ossification at only the center of the bone. The bones also lack the normal square appearance of fully ossified bones. Factors that can contribute to cuboidal bone hypoplasia are:

metabolic disease during pregnancy, twin pregnancy, prematurity/dysmature, and a less than ideal intrauterine environment (2).

An additional perinatal factor is weakness of periarticular structures. This is caused by laxity and insufficient strength in tendons, ligaments, and joint capsules. Valgus is the most common confirmation seen with this affliction (2). It is caused by abnormal loading on the articular surface of the joint which causes the limb to deviate laterally. However, the limb can be straightened and even manipulated to a varus conformation. Contributing factors include: abnormal development of long bones, hormonal disproportions in gestation, and intrauterine malposition (2)(3).

Rotational deformities are another perinatal factor that contribute to angular limb deformities. Rotational deformities are the most commonly observed conformation problems in foals (1). From a distance a slight outward rotation is often noticed in the frontal plane. This deformity is usually self-limiting; however, and will often correct itself as the foal grows and its chest widens (5).

The other category of factors that can contribute to angular limb deformities are developmental factors such as unbalanced nutrition. Feeding on pastures that have not been properly fertilized, taking in excessive grain, exhaustion, and “creep-feeding” can all contribute to a foal developing angular limb deformities (2).

Excessive exercise and trauma can also lead to the development of angular limb deformities. This can come in the form of micro-fractures, or crushing of bone, while still in the growth process. The early closure of growth plates can also lead to angular limb deformities in the form of a Salter Harris Type V fractures (2).

Epiphyseal and metaphyseal dysplasia are developmental factors that can cause limb deformities. The most commonly affected bones by this developmental factor are the distal portion of metacarpal bone III and the distal portion of the radius (2). Epiphyseal wedging and flared metaphysis can also be seen, and they are usually considered secondary deformities. Upon radiographing a limb with suspected angular limb deformity one could possibly see widened and rough physeal edges, subchondral sclerosis, and physeal osteophytes (2).

DIAGNOSIS

The diagnosis of angular limb deformities is straight forward. Usually performing a good physical examination with observation from a distance, attempted physical manipulation, and radiographic examination are standard. When presented with a foal that has an angular limb deformity, it is best to observe from a distance first (4). Observing from a distance will help guide in the determination of not only the presence, but also the type of the deformity (i.e. valgus or varus)

The next step in examination of a foal with an angular limb deformity is attempted physical manipulation of the deformity. Manipulation of the deformity will help to aide in discovering the etiology of the deformity (5). If the limb can be straightened, perinatal factors are likely the cause of the deformity. If the limb cannot be straightened by physical manipulation the likely etiology is a developmental factor (3).

The final and most important aspect utilized for the diagnosis of angular limb deformities is diagnostic imaging, namely radiographs. Radiographs of the structures in question can reveal the exact area and possible etiology for an angular limb deformity. Radiographs definitively show the type and degree of the deformity in question, and they can also guide in presumption of the origin of the deformity (2).

TREATMENT AND MANAGEMENT

There are numerous ways to treat and manage angular limb deformities ranging from non-surgical to surgical methods. The most commonly recognized methods of treatment will be mentioned below.

NON-SURGICAL

Stall rest: Stall rest in generally indicated in instances of cuboidal bone hypoplasia, periarticular laxity, and physeal and diaphyseal growth disturbances. Stall rest gives hypoplastic bones time to completely ossify, and it gives time for other bones and structures to grow and correct themselves on their own (4). Radiographs are usually taken in two week intervals to judge if the foal has had a positive response to stall rest (7).

Splints and casts: Splints and casts can be indicated in the instances of cuboidal bone hypoplasia and periarticular laxity and weakness, but they are contraindicated in deformities arising from the physis, as they can create pressure sores and tend to weaken the tendons in the immediate area. (2). Splints should be changed every 3-4 days, and casts changed every 10-14 days. As with stall rest, radiographs should be taken every 2-3 weeks to monitor progress (2).

Corrective hoof Trimming: Corrective hoof trimming is used in foals with mild angular limb deformities and is regularly used in conjunction with surgical intervention (4). For valgus deformities the outside half of the hoof wall is shortened with a rasp, and for varus deformities the inside half of the hoof wall should be shortened with a rasp. Corrective trimming may help a foal with very mild angular limb deformities avoid surgery with proper stall rest.

Extracorpeal Shockwave Therapy: Extracorpeal shockwave therapy is a new method of treatment aimed at angular limb deformities in foals. The shockwave forces growth retardation on a growing physis when treatment is applied. For foals, the treatment is applied to the convex physis while under sedation once weekly. The foal is then monitored for signs of straightening of the affected limb. If no progress is made after several weeks, surgical intervention may be required (6).

SURGICAL

Growth Acceleration

Periosteal transection and striping: Periosteal transection and striping procedures are used to accelerate the growth of a bone (1). In foals the procedure is performed on the concave aspect of the bone. The procedure is performed by making an incision in the periosteum in a craniocaudal direction and then making another incision in the periosteum in a caudocranial direction to meet the first. Another incision is made running proximal to distal meeting the previous two where they intersect at their midpoint (forming an upside-down ‘T’). The flaps created by the incision are then elevated and smoothed back down. This helps to accelerate growth in the bone, and physiological over-correction on the foal’s part is not possible. The procedure uses no implants, and when done correctly it yields good cosmetic results (2). When treating carpal valgus by means of periosteal stripping, the distal portion of the ulna is either transected with a scalpel blade or a small portion of it is removed with a rongeur so that it cannot inhibit growth of the radius.

Growth Retardation

Transphyseal bridging: Transphyseal bridging is a growth retardation procedure that is performed on the convex side of the bone. Transphyseal bridging utilizes implants to slow down the growth of bone on one aspect of the limb (1). There are different techniques that can be used in a transphyseal bridging procedure: stapling, screws with cerclage wire, screws with a bone plate, and single screw placement (2). Stapling is performed by placing one arm of the staple into the epiphysis of the affected bone and another into the adjacent metaphysis. This technique is not normally executed as there is no immediate effect seen in the foal. Screw and cerclage wire is the most commonly performed procedure. This technique involves one screw placed in the convex aspect of the metaphysis of the afflicted bone and one in the epiphysis of the same bone. Cerclage wire is then wrapped around the two screws in a figure-8 fashion (1). Once proper growth has occurred on the affected side of the bone, the implants can be removed via stab incisions (2). This technique yields a high success rate and great cosmetic results if done properly. Another technique is the use of screws and a bone plate. The screws are placed in the same anatomical locations as if using the previously mentioned cerclage wire technique; however, a bone plate is positioned in the place of cerclage wire. The drawback of this technique is the cost of the implant. However, there is a good success rate with this procedure, and it usually yields excellent cosmetic results (2). Single screw placement is a more recent technique that involves placing one screw through the physis at a 60-degree angle. The tension created by the screw slows down growth until the screw is later removed via stab incision. This procedure also yields a high success rate.

Corrective Osteotomies

A corrective osteotomy is indicated if the foal, particularly a miniature foal, has complete ulnas. The ulnas can act as a tethering mechanism which most likely will not allow the concave aspect of the affected bone to grow and mature correctly or as quickly as needed (2). The guiding principle behind a corrective osteotomy is the removal of bone. When the ulna is involved, usually the most distal portion is removed. The procedure can be done at the same time as the corrective procedure for an angular limb deformity.

CASE OUTCOME

Radiographs of Ranger's forelimbs showed appropriate cuboidal ossification for his age; therefore, incomplete ossification of carpal or tarsal bones/cuboidal bone hypoplasia could be ruled out as an etiology. Ranger's defects could not be manipulated in such a way that any instability was revealed, and no defects could be manually corrected or rotated in another direction. Based on this, laxity of periarticular structures and rotational deformities could also be ruled out as etiologies for Ranger's angular limb deformity. Ranger's radiographs did reveal bilateral, asymmetric growth of his lateral radial epiphysis. It was determined that epiphyseal/metaphyseal dysplasia with bilaterally complete ulnas was the etiology of his bilateral carpal valgus, though the exact cause of Ranger's dysplasia was not known.

On August 2, 2016 Ranger underwent a bilateral periosteal stripping procedure with bilateral ulnar osteotomies. Ranger was sedated with xylazine, and a catheter was placed into his left jugular vein. General anesthesia was induced with propofol. He was maintained under general anesthesia on isoflurane and oxygen for the entire procedure. He was initially placed in right lateral recumbency and the uppermost (left) leg was aseptically prepped. He was flipped to left lateral recumbency part-way through the procedure.

A 3cm vertical skin incision was made on the lateral aspect of the left forelimb between the common and lateral digital extensor tendons, and it extended about 0.5cm proximal to the distal radial physis. The underlying subcutaneous tissues and fascia were dissected to expose the common digital extensor tendon. Mosquito hemostats were used to underpass cranially to expose the underlying periosteum. The tendon was protected with the hemostats, while an incision was made in the periosteum in a craniocaudal direction. Following this, the lateral digital extensor was isolated in a similar way to the common so that a second periosteal incision could be made. This incision ran in a caudocranial direction to meet the first.

Following completion of this hemicircumferential incision, a vertical central incision was extended approximately 2.5cm in a proximodistal direction. The periosteal flaps created by the incisions in the periosteum were then elevated with the back of the scalpel handle. The flaps were smoothed back down along the distal radius. The left ulna was noted to be complete and had not completely ossified along its length. The most distal aspect of the left ulna was removed using a ronguer. The fascia and subcutaneous tissues were closed with 3-0 monocryl with a simple continuous pattern. The overlying skin was closed with a cruciate pattern using 3-0 PDS.

Ranger was then flipped into left lateral recumbency, and his right leg was prepped in the same fashion as the left. The periosteal stripping was performed in the same manner as the left limb. The ulna on the right side was fully ossified and was transected approximately 2cm proximal to the distal radial physis. The previously described two-layer closure was repeated for this limb.

Ranger's legs were then bandaged, and a tetanus vaccine was administered. He recovered from general anesthesia without any complications and was returned to his dam. Ranger was placed on two different medications: Trimethoprim/Sulfa (an antibiotic), and Flunixin (an NSAID). Ranger went home the next day with instructions for his owners to change his bandages 3 days post-surgery then every 3-4 days until his return visit on August 15th. Ranger did not return for his visit; however, his owners say he is doing well and enjoying life.

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