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Management of Angular and Flexural Disorders in Foals

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Take Home Message

Management of angular and flexural limb deformities varies with the type of deformity and age of patient. Some deformities self correct while others require surgical management. The combination of proper trimming, controlled exercise, frequent evaluations and occasional surgical intervention is required for management of these disorders.

Introduction

Orthopedic problems in foals can be both congenital and acquired. Congenital orthopedic disorders are present at birth and usually obvious. In extreme cases, congenital angular and flexural deformities can lead to dystocia and in some cases necessitate fetotomy or cesarean section to relieve the dystocia. Many foals are born with some degree of flexural or angular limb problem. The most common appearance is a degree of flexor laxity and carpal and/or tarsal valgus deformity. Fortunately, these deformities usually self correct with exercise and age and should be considered normal findings in a newborn foal. Likewise, congenital flexural deformity of both the metacarpal/tarsal phalangeal joint, distal interphalangeal joint and carpus may be present. Mild forms of these conditions will self correct with age and exercise but in our experience moderate to severe congenital flexural deformity usually requires some type of intervention.

One of the more important aspects of conformational evaluation of a foal is to understand your client and the potential use of the horse. The level of criticism and aggressiveness of intervention is related to the foal’s future use. Foals destined for weanling or yearling sales may be treated in some circumstances differently than foals destined for other uses. Regardless of the circumstances, certain deformities such as fetlock varus and flexural deformities are generally associated with future unsoundness and may require intervention regardless of the future use of the foal. Conformational evaluations generally start at 3 – 4 weeks of age unless more serious abnormalities exist. The foal is usually best observed walking with the mare with a handler although for some foals no restraint is best. Evaluation during locomotion is required for angular limb evaluation and evaluation of the foal at rest is best for flexural conformation. Knowledge of previous offspring of the mare is helpful in assessing the importance of abnormalities in a foal. Repeat examination is generally done at 2 to 3 week intervals. Preferably the foal is examined after trimming. It is important, however, to bear in mind what effect the trimming has on the appearance of the limb and to visualize what the limb would look like without corrective trimming.
Flexural Deformity (Contracted Tendons)

Flexural deformity can be congenital or acquired. The congenital form may involve the carpus, fetlock and/or coffin joints.

Acquired flexural deformity of the coffin joint typically occurs in 4 - 8 month old horses. Flexural deformity of the fetlock joint occurs in 8 - 14 month old horses. Acquired flexural deformity of the carpus is unusual unless associated with a severe lameness in that limb.

Congenital Flexural Deformities

In neonates with congenital flexural deformity exercise, splints, casts and oxytetracycline have been used to achieve tendon laxity. In mild cases of flexural deformity corrective hoof trimming and exercise are often curative. The uses of polyvinyl chloride (PVC) splints placed over a padded bandage are used to place the limb in a weight bearing position. In is important to reset the splints daily and to use well-padded bandages to prevent rub sores, which easily occur in foals. We recommend placing the splints in the morning and removing them at night and repeating this procedure daily. Casting will also cause flexor tendon laxity. Casts should be left on no longer than 10 days and early removal may be necessary if a cast rub is suspected.

The use of the antimicrobial oxytetracycline to induce tendon relaxation has gained acceptance. It is thought that the oxytetracycline binds calcium and causes muscle relaxation and effective lengthening of the musculotendinous unit. Three grams of oxytetracycline is given intravenously. A lower dose can also be used. Since this is such a large dose the authors usually dilute the drug in 1 liter of saline and gives it over a 15 minute period. In the United States oxytetracycline is not approved for use in the horse so it is important to inform the client of this and of the potential side effects, which include diarrhea, renal failure and acute death. We have not witnessed these side effects in our use of this drug. In foals less than 2 weeks of age the effects are often dramatic and occasionally flexor laxity may occur. If the desired effect is not seen then a second or third dose in given on successive days. Splinting is often used in concert with oxytetracycline treatment. Oxytetracycline has proven to be an effective medical treatment in the management of flexural deformities in foals less than 2 weeks of age. In older foals (greater than 30 days), oxytetracycline treatment is often not effective probably due to the increased muscular development in these foals.

Acquired Flexural Deformities

Acquired flexural deformity of the coffin joint is usually seen in foals between 4 and 8 months and is associated with large, fast growing foals on a high plane of nutrition. Nonsurgical methods of correction include toe extension with or without shoes, phenylbutazone and exercise and are chosen for mild cases. For cases which are moderate to severe in nature or unresponsive to medical treatment, inferior check ligament desmotomy and extended toe shoes are recommended. Correction after inferior check ligament desmotomy is usually dramatic and immediate. Corrective shoes usually are necessary for 4 - 8 weeks post-operatively.

Acquired flexural deformity of the fetlock joint is usually seen between 8 to 14 months of age and is also associated with large, fast growing foals on a high plane of nutrition. In general nonsurgical methods are only helpful in the mild cases and consist of raising the heel with a
wedge pad, phenylbutazone and exercise. For cases that are moderate to severe in nature or unresponsive to medical treatment, proximal check ligament desmotomy and elevation of the heels with wedge pads is recommended. For horses whose fetlocks are beyond vertical and therefore cannot load their tendons adequately for conservative management to work, surgical treatment is recommended. In some severe cases, a distal check ligament desmotomy and splinting are often combined with the proximal check ligament desmotomy to achieve maximal tendon/muscle unit lengthening. Initially, this condition was considered to be associated with shortening of the superficial flexor tendon unit and surgical treatments were aimed at either superficial digital flexor tenotomy or superior check desmotomy. However, if these cases are carefully examined, it is often the deep flexor tendon unit that is the tightest in these cases as well (particularly when the leg is raised and the foot extended). In these cases, the most effective method of treatment is an inferior check desmotomy combined with a PVC splint that is bent to pull back the fetlock joint. In some severe cases, a distal check ligament desmotomy and splinting are often combined with a proximal check desmotomy to achieve maximum tendon/muscle unit lengthening. In some instances, suspensory contracture and fetlock joint capsule contracture prevent resolution even after the above surgical procedures.

Additional Reading (Flexural Deformities)


Angular Deformities
Deformities Associated with Physeal Growth Imbalance

Most foals are born with some degree of carpal and tarsal valgus deformity. This is generally considered normal. As the foal matures many angular deformities improve and completely resolve. Moderate to severe (>10 degrees) valgus deformities that are still present at 6 weeks are considered abnormal and require evaluation. Causes of valgus deformity include ligamentous joint laxity, physeal dysplasia and cuboidal bone abnormalities. Ligamentous joint laxity can be assessed by manipulation of the foal’s limb. Deformities of the fetlock are generally varus and can be congenital or acquired. Occasionally fetlock varus is caused by a congenital bowing of the cannon bone leading to a secondary fetlock deformity. Radiographs are required to diagnose physeal dysplasia or cuboidal bone problems. Dorsopalmar radiographs reveal the location of the angular deformity by the center of the angle formed by lines drawn down the center of the phalanges, metacarpus and/or radius. If the lines meet in the physis or epiphysis then the abnormality originates from the physis. If the lines meet in the carpus then the source are the cuboidal bones. Fortunately, most of the boney causes for angular limb deformities are in the physis, which is correctable surgically. Acquired angular limb deformities are generally seen in the fetlock starting at approximately 30 days. An interesting sub group of foals are those which appear normal until approximately 8 to 12 weeks of age and then “suddenly” become varus in the fetlocks (there is often a rotational component here). These foals tend to be offset in the carpus and therefore have a predisposition for fetlock and/or carpal varus deformities as they mature.

Trimming and corrective shoeing (extensions) are effective methods of encouraging normal growth of a foal. The use of corrective trimming requires attentiveness and persistence. Many foals with can be managed this way. For varus deformities of the fetlock reduction of the medial wall promotes an outward appearance and encourages more “normal” bone growth. The use of medial or lateral extensions using hoof acrylic or glue on shoes allow normal loading of the limb and promote correct limb growth. Care should be taken to avoid excessive extensions as this can lead to difficulties in ambulation, abnormal forces on the hoof and lameness.

Surgical intervention is indicated in cases of fetlock varus and/or inward rotation when conservative means have not effected a response by 2 months of age. Surgical options are discussed below. In instances of carpal valgus there is a much longer “window of opportunity”. As indicated above, carpal valgus of greater than 10 degrees that are still present at 6 weeks are considered abnormal. Unless a severe angular limb deformity is causing secondary problems in the joint capsule, one can wait a considerable period of time before intervention. Periosteal elevation and transection is commonly done on these foals quite early; whether this contributes to the correction is controversial (see also below). Transphyseal bridging can be done to correct carpal valgus up to a year of age, but the anticipated response decreases as the foal gets older. An indication for immediate intervention is carpal varus (often with a degree of offset knees). This can sometimes show up “suddenly” at the yearling stage and is treated with transphyseal bridging of the lateral side of the distal radial physis.

Periosteal elevation and transection has been used as a means of correcting angular limb deformities in growing horses for over twenty five years. In recent years, controversy has grown over its effectiveness or necessity. Here are various reports as to its efficacy and also correction in the absence of surgery. It is the first author’s opinion that periosteal elevation and transection
is still used as a means to correct angular limb deformities and will remain so in the foreseeable future. It is also recognized that the procedure, particularly when applied to the fetlock, is being frequently replaced with single screw transphyseal bridging. The surgery is performed on the “short” side of the bone (in the case of a valgus deformity on the lateral side) and the transection performed 2 cm proximal to the physis. Growth acceleration occurs on the operated side and overcorrection is not possible. Surgical correction for fetlock deformities should be performed before 8 weeks of age and carpal deformities by 4 months of age. It is the first author’s observation that the earlier the surgery is performed the more rapid the correction; however case selection is important since some foals will self correct. The second author is more skeptical of the value of periosteal elevation. This opinion is based on observation of foals treated with periosteal elevation and there are two main issues of potential confusion. With periosteal elevation in cases of carpal valgus, do veterinarians get undue credit for “correcting” carpal valgus when nature is taking care of it? Also, recent publications provide reasonable evidence that correction does not change between foals treated with periosteal elevation and not treated.

An experimental study on 8 mixed bred foals with a mean age of 33 days and carpal angles between 0 and 8 degrees was done in which drill holes were used as reference points in both the proximal and distal radial metaphases to prove whether there was a difference in growth rate between medial and lateral aspects of the radius at the end of the bone. Periosteal transection was done and there was no tendency for the angle to change. There was no statistically significant difference between medial and lateral growth rates at either the proximal or distal end of the radius that could be detected between principal and control limbs. The authors suggested that the discrepancy between their data and previous publications of AUER, regarding the production of a valgus deformity could be explained by the lack of precision and drawing bisecting lines on radiographs and possibly that bone production on the medial side of the distal radius as a result of the periosteal transection might influence the position of the line bisecting the radius further medially than the original true center of the radius. In another study with ten 30-day old foals, a transphyseal bridge implant was placed on the lateral aspect of both distal radial physis. At 90 days of age, or when 15 degrees of angulation has developed, the implants were removed and hemi-circumferential periosteal transection and elevation (HCPTE) was performed on one limb. At the time of transphyseal bridge removal and HCPTE, both treated in control limbs were observed to have a significantly greater carpal valgus, compared with the initial degree of angulation at 30 days of age. Following HCPTE or sham surgery all limbs straightened over the subsequent two months of the study. Median angulation was not significantly different between treated and control limbs at any time during the study. These results suggested that foals with an experimentally induced limb deformity, HCPTE was no more effective than stall confinement or hoof trimming alone for correction of the deformity. The authors also noted that in limbs that underwent HCPTE, a small localized soft tissue swelling developed in the region just proximal to the distal radial physis. This swelling was not evident in the control limbs and it was felt that the soft tissue swelling created the illusion that the limb that underwent HCPTE was straighter than the control limb. However, when radiographs were examined, there was not significant difference in angulation between treated and control limbs. The authors suggested that this soft tissue swelling accounted for the perceived rapid correction in angular limb deformities following HCPTE in previous reports. This could account for the popularity of HCPTE as it would appear to result in almost improvement in the appearance of the limb post-operatively. In the case of fetlock varus and rotational deformities of the fetlock joint (toeing-in), trimming is always occurring at the same time as the surgical procedure and it is debatable which part is mostly responsible for correction.
In cases of moderate to severe angular deformity or in older foals and yearlings, physeal retardation with screws and wires or transphyseal screws are necessary to slow the growth on the “long” side of the bone. In the fetlock region, physeal retardation is nearly exclusively accomplished with transphyseal screws (except in foals less than 2 – 3 weeks) and that of the carpus with screws and wires up through approximately 14 months of age. After 14 months it is generally safe to use transphyseal screws with limited risks of overcorrection of the carpus in yearlings after removal. Overcorrection after transphyseal bridging (particularly of the carpus) using any means, however, is possible without careful observation and it is important to inform an owner of this possibility prior to surgery. Implant removal with physeal retardation is required. Aside from over correction, soft tissue swelling and infection are potential complications of transphyseal bridging. As mentioned previously, cases of severely offset knees with a carpal varus component can be helped with transphyseal bridging of the lateral side of the distal radial physis. It should also be noted that one study of conformation and its effect on racing soundness showed that in some degree of carpal valgus angle, if protective against carpal problems, it was desirable to have a slight degree of carpal valgus remaining in the adult equine athlete.

Incomplete Ossification of Carpal and Tarsal Bones in Foals

Foals affected with this syndrome typically present with an angular limb deformity (carpal valgus in the forelimbs or hyper-extension and a broken distal tarsal axis) or (“sickle-hocked in the hind limbs). Lameness is not typically present in the forelimbs unless secondary osteoarthritis or clinical OCD is present, but with astute clinical examination, the condition will be noted to affect the gait in the hind legs. The condition is regularly seen in premature foals. Generally the carpal and tarsal bones have small, rounded ossified nucleus with thick overlying cartilage. The decreased ossification principally involves third, fourth and ulnar carpal bones. However, it is recognized that all carpal bones can be affected with radial carpal bone resulting in carpal varus. The carpal and tarsal bones ossify in the last 2-3 months of gestation, with ossification of the cartilaginous templates and cuboidal bones occurring from the center to the periphery by intercondylar ossification. For many foals born towards the end of cuboidal bone ossification, a thick layer of cartilage surrounds the spherically ossified portions of the bones. However, at birth, ossification normally extends almost to the periphery of the cartilaginous template, but there is a considerable degree of variation. This maturity can be associated with a number of conditions in the mare. The cartilaginous precursors of the epiphysis and cuboidal bones of the carpus and tarsus are soft and partially deformable and because newborn foals have some degree of angular deformity (particularly carpal valgus), the articular loading forces are not distributed perpendicularly to the long axis and stress concentration can occur in certain locations. This results in compression of the bones. In the hind limb, the delayed ossification occurs in a sagittal plane. The condition is mainly associated with prematurity and hypothyroidism.

Initial recommendations for treatment of these cases was to place the foal under general anesthesia, manually straighten the limb and apply a combination cast to immobilize the distal metacarpus. Usually after 4 weeks of cast immobilization, there will be radiographic evidence of completed ossification and clinical evidence of stability (cast change typically being done at 2 weeks). More recently the use of modified splints instead of a cast has been made as well in order to maintain a straight limb and decrease the weight-bearing on the wedge portion of the
bone. The prognosis will depend on the amount of normal cuboidal ossification that occurs and in absence of accompanying OCD or osteoarthritis lesions.

Wedge Osteotomy for Severe Angular Limb Deformities with Closure of Growth Plate

This is an uncommon indication, but if physeal growth has ceased and there is undesirable angular limb deformity, then wedge osteotomy is an option. Cases involving the distal metacarpal or metatarsal physis treated with wedge osteotomy have been described. More recently step osteotomy rather than a wedge osteotomy has been described as preferable. A wedge osteotomy at the level of the distal radius is a more serious procedure.

Additional Reading (Angular Limb Deformities)