Angular Limb Deformities and Physitis

Dean A. Hendrickson, DVM, MS
Diplomate American College of Veterinary Surgeons
College of Veterinary Medicine and Biomedical Sciences
Department of Clinical Sciences
Colorado State University

Angular Limb Deformities

Description
Angular limb deformity in the equine neonate can take the form of a lateral or medial deviation of the limb. The angulation can arise from any of the physes or the cuboidal bones of the carpus and tarsus. The most common physes involved are those of the distal radius, tibia, metacarpus and metatarsus. A deviation laterally is termed valgus while a medial deviation is termed varus. The nomenclature is derived by combining the name of the involved joint (i.e. with cuboidal bone abnormalities) or the joint immediately distal to the affected growth plate, and the type of deviation. For example a lateral deviation of the distal limb due to an affected distal radial growth plate or abnormal cuboidal bones of the carpus would be termed carpal valgus.

Etiology
The etiology of angular limb deformities is complex and is thought to be multifactorial. According to Auer (1992), there are two main categories of factors including perinatal and developmental. These effects are summarized in Table 1. Perinatal factors are usually involved when a foal is born with an angular limb deformity, whereas foals that are normal at birth but develop an angular limb deformity are more likely to suffer from one or more of the developmental factors. This list is not all-inclusive.
Clinical and Physical Examination
It is important that an adequate physical examination be performed on all foals. This is especially important in foals that have deformities involving the carpus or tarsus. If the deformity is manually reducible there is a possibility of cuboidal bone collapse. The only way to definitively determine if this condition exists is by radiography. Radiographs including the cranial to caudal and lateral to medial views, are very helpful in the treatment of angular limb deformities, both in helping to determine the therapy of choice, and as a prognostic indicator. They enable the practitioner and the farrier to determine if there are any bony abnormalities such as incomplete ossification of the cuboidal bones or complete premature closure of the physis. Radiographs are necessary to determine the center of deviation which is imperative if surgical correction is to be performed. Radiographs will also allow follow-up to determine if conservative therapy has been effective.

In a certain number of cases there will be a rotational deformity present in conjunction with the angular deformity.
**Therapeutic options**

The therapeutic options vary depending on the cause and the severity of the angular limb deformity. The various therapeutic options are placed into two main categories; conservative or nonsurgical, and surgical. It is important to remember that only certain types of deformities are amenable to conservative therapy such as rest and corrective trimming and shoeing. This makes the physical examination all the more important. Foals with angular deformities greater than 15 degrees, or with cuboidal bone collapse are not candidates for conservative therapy. It is also important to remember that the physes will eventually close, and at that time nothing short of a wedge ostectomy will correct the angular deformity. A good rule of thumb is to only attempt conservative therapy up to 2-3 weeks of age for the fetlock and up to 2-3 months of age for the carpus and tarsus. At this time periosteal stripping should be very strongly considered. By 4 weeks for the fetlock, and 4 months for the carpus/tarsus, some type of transphyseal bridging will probably be necessary in all but the very mild angular deformities. On average radiographic closure of the physes occurs at 9 and 21 months respectively for the distal metacarpal/metatarsal and distal radius/tibia physes (Fig 2). This by no means suggests that therapy can be attempted this late as actual growth ceases prior to radiographic closure.

**Conservative Therapy: Controlled Exercise** - A large number of foals are noticed to have some type of angular deformity at birth. In most instances this type of deformity can be corrected with the proper conservative therapy such as stall rest until the angulation has been corrected. Keep in mind the above time periods when attempting conservative therapy.

Continued exercise in the face of an angular limb deformity can cause compression of the growth plate on the concave side of the physis. Although some compression seems to stimulate growth, too much compression can actually impede growth.

**Conservative Therapy: Corrective Trimming and Shoeing** - Corrective trimming should be performed on all foals that are confined in order to accentuate the benefit of stall rest. If the feet are trimmed properly, the weight distribution across the physis changes and it will adapt its growth in order to straighten the leg. In valgus deformities the outside half of the hoof should be shortened, and in varus deformities the inside of the hoof should be shortened. The trimming should consist of simply rasping the appropriate portion of the hoof wall every week while the animal is confined. Excess removal of hoof wall will only add undue stresses to the articular cartilage of the joints and lead to early degeneration of the cartilage. It is important to monitor the shape of the hoof to decrease the likelihood of causing permanent deformation of the hoof. Corrective trimming can be used with any of the surgical techniques that are commonly performed.

Corrective shoeing can be a helpful adjunct therapy to either conservative stall rest or surgical therapy. Corrective shoeing is particularly helpful in cases of ligament laxity with concurrent angular deformation. In general the shoeing is performed in such a manner as to accentuate the corrective trimming described above. In trimming the goal is to trim the side of the foot that is in the direction of the angular deformity (e.g. lateral hoof wall for lateral/varus deformity), and therefore force the longer hoof wall to come in contact to the ground first causing the foot to turn away from the present deformity. Simply put, if the medial hoof wall is longest, and hits the ground first, the toe will be forced medially. In some foals there is not enough hoof wall to do any trimming, or the foals may have concurrent ligament laxity of some variety and may not walk on the foot normally. In these cases, metal plates or more recently glue on shoes can be of great benefit. With these plates and shoes you can come up with just about any configuration you want. The goal is to add an extension that will perform the same task as the longer hoof wall does with trimming. Specifically for valgus or lateral deformities an extension would be placed on the medial side of the foot. A lateral extension would be used for a varus deformity. If the foal also has flexor ligament laxity, a palmar/plantar extension can be added.

Care must be taken when applying glue on shoes. It is important not to have the shoe come to or above the coronary band at any point. The most common site of problems is in the heel area where foals have very little hoof wall to begin with. It is also important to remove/reset the shoes every 2 weeks in order to allow the foot to grow and expand. By virtue of their holding power, the shoes do not allow expansion or outward growth of the foot. The shoes should be left off for at least 2 days before reapplication. As with trimming it
is important to remember the guidelines for physeal closure. If the foals are getting too old, surgery may need to be added to the therapeutic plan in order to achieve the best results.

**Cast application** - Cast application is most beneficial in cases of cuboidal bone collapse or collateral ligament laxity. Casting is not indicated in cases of pure physeal abnormalities. It is important to use a tube cast in order to decrease the incidence of flexor ligament laxity. Because of the rapid growth of foals at this age, the cast should be changed every 2-3 weeks, and may need to be reset multiple times. Radiographs are necessary to determine if the bones have gone on to ossify normally.

**Surgical Options** - Surgery becomes necessary in some cases if the best possible outcome is desired. There are different surgical options, some depending on the severity of the angulation, and others on the surgeon's preference.

**Periosteal Stripping** - Periosteal stripping is performed on the concave surface of the limb, just proximal to the affected growth plate. Periosteal stripping is only beneficial in cases where the angular deformity is coming from an active growth plate. The exact mechanism that improves angular deformities after periosteal stripping is unknown. One belief is that after periosteal stripping, the blood supply to the affected growth plate is improved. Another belief is that the thickened periosteum acts as a bow string, and when cut relieves the tension, and allows the growth to resume.

Periosteal stripping can be performed at any time and is beneficial up to the time that the growth plates close, but is most effective prior to 4 weeks in the distal metacarpus/metatarsus, and 4 months in the distal radius/tibia. It is generally recommended that if stripping is to be used alone, that it be performed at or prior to 3 weeks and 3 months for the distal metacarpus/metatarsus and distal radius/tibia respectively. After the 4 weeks/4 months guidelines, stripping should be combined with some type of transphyseal bridging for best results. The benefits of periosteal stripping are that the leg will never over correct, and that it can be done more than once. The drawbacks of periosteal stripping is that it is unlikely to provide enough straightening with legs that are deviated more than 15 degrees, and stripping alone is unlikely to improve any type of rotational deviation.

**Transphyseal bridging** - Transphyseal bridging should be used in any case in which the deformity is 15 degrees or greater, or after 4 weeks in the distal metacarpus/metatarsus, and 4 months in the distal radius/tibia. There are different techniques used to bridge the physis. The basic premise is to retard the growth of the convex surface of the limb by bridging the physis with some type of mechanical device such as bone screws and wires, staples, or bone screws and small bone plates. All of the techniques have there positive aspects, and drawbacks. Surgeons preference usually dictates the method chosen. Transphyseal bridging can be used in any area that there is an active physis, but as the animal gets older and the physis has less growth, the amount of straightening is diminished. Transphyseal bridging can and often is used in conjunction with periosteal stripping and corrective trimming/shoeing. The major drawback to transphyseal bridging is that it requires a second surgery to remove the implants. The implants should be removed as soon as the leg is straight. If the implants are not removed the angular deformity will over-correct, and the leg will acquire a deformity in the opposite direction. The implants can be placed at an angle to help correct rotational deformities.

**Corrective Wedge Osteotomy/Ostectomy** - Once the growth plates have closed or calcified, none of the above techniques will be useful. Corrective trimming and shoeing in excess will only serve to place uneven pressures and stresses on the joints, causing degeneration of the articular cartilage and eventually arthritis. This is an expensive and difficult procedure, and often times will not provide an athletically sound animal.

<table>
<thead>
<tr>
<th>Region/Treatment</th>
<th>Conservative Treatment</th>
<th>Periosteal Stripping</th>
<th>Transphyseal Bridging</th>
<th>Cessation of Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fetlock</td>
<td>&lt;2-3 weeks</td>
<td>&lt;4 weeks</td>
<td>4 weeks</td>
<td>9 months</td>
</tr>
</tbody>
</table>
Figure 2. General guidelines for conservative and surgical therapies.

References


Physitis

Description Physitis, also known as epiphysitis, occurs when endochondral ossification is interrupted in the metaphyseal growth cartilage. These type of osteochondritic lesions have been found in foals, and may predispose the underlying subchondral bone to microfracture. Following the microfracture, signs of pain, lameness, and sensitivity to palpation are evident. As the severity of the lesions worsen, partial loss of the structural integrity of the physis stimulates periosteal new bone formation, and the metaphysis acquires a flared appearance. Further remodeling is seen radiographically as increased radiolucency, giving the appearance of widening at the physeal growth cartilage, which is bordered by a margin of sclerotic bone formed in the surrounding metaphysis.

Etiology The etiology of physitis is probably similar to OCD, in that nutritional excesses, deficiencies, or imbalances seem to be prevalent. High energy diets seem to be particularly represented in cases of physitis.

Clinical Findings Clinically, horses generally present between 4 and 8 months of age. Occasionally, two year old horses that have recently entered training are affected. Signs are usually seen in the distal radius and tibia, distal MCIII and MTIII (cannon bones), and occasionally in the proximal first phalanx (long pastern). Lameness varies from slight stiffness to overt lameness with reluctance to stand. The affected physes have the typical flared appearance. In severe cases, flexural and angular limb deformities may accompany the disease. Flexural deformities are thought to be secondary to chronic pain which initiates a protracted withdrawal reflex. Angular limb deformities may develop secondary to the disturbed bone growth when one side of the physis is more or less involved than the other side.

Treatment The treatment of physitis is aimed at correcting the underlying nutritional deficiencies, excesses, or imbalances. Restriction of exercise is indicated when moderate to severe lameness is present to prevent further injury. Nonsteroidal anti-inflammatory drugs may relieve some of the pain associated with the conditions. With minimal lameness, controlled exercise is allowed, which maintains normal joint and tendon function. Fortunately, physitis is a self-limiting disease, with resolution occurring when skeletal maturity is reached and growth at the affected physis ceases.