Angular limb deformities are defined as medial or lateral deviations of the limb in a frontal plane. Careful clinical assessment is required to define the deformity. This should include examination whilst standing square and with the limbs positioned straight beneath the body and when walking. Visual assessment should be made from directly in front of the joint being assessed to avoid misinterpretation as a result of concurrent rotational deformity. Radiographic examination is also critical in assessment and, in addition, enables quantitative evaluation of the pivot point and pivot point angle.

When assessing a foal with an angular limb deformity, the clinician must consider the age of the foal, the remaining growth potential at the site of angular deformity, cause and severity of deformity. Only after considering these factors can a suitable treatment plan be formulated.

**Congenital deformities**

**Periarticular laxity**
This is a common cause of angular limb deformity in neonates, requiring no intervention other than limiting exercise. Dramatic improvement is usually seen within the first few weeks of life.

**Cuboidal bone hypoplasia**
This condition most frequently results in angular limb deformities at the carpus and is seen most commonly in premature and dysmature foals. The angular deformity develops after the foal begins to weight bear, due to plastic deformation of the cartilaginous precursors of the cuboidal bones. Confinement is indicated to minimise stresses of load bearing. When severe, the limbs should be maintained in normal alignment by sleeve cast immobilisation. Casts should be maintained for 10–14 days before removal and re-evaluation both clinically and radiographically.

**Acquired deformities**
Angular limb deformities also will (commonly) result from disproportionate growth at the level of the physis. These occur as a result of developmental factors after birth. If relatively more growth occurs at the medial aspect of the physis, varus deformities occur. Conversely, if more growth occurs at the lateral aspect of the physis, valgus deformities occur. The most common deformities seen in the UK are carpal valgus deformities, and fetlock varus deformities.

**Conservative management**
In most cases, minimal intervention is all that is required to correct angular limb deformities. This includes exercise restriction and careful attention to the foot. In the first instance, the foot should be carefully balanced. Extensions alter the weightbearing surface of the foot and, in turn, axial load of the limb, in the direction of the extension. By applying the extension to the lateral aspect of the hoof with varus deformities and the medial aspect with valgus deformities, a more physiological axial loading of the limb (and physis) is achieved (Greet and Curtis 2003). This in turn encourages correction of the angular deformity. In the author’s hands, the most simple and effective type of extension is a moulded polymer urethane (Equithane®) bonded directly to the hoof.

**Surgical management**
Surgical intervention is based on the fact that the vast majority of bone growth occurs at the level of the physis. Any intervention performed has the aim of altering the growth process at the physis. Although a number of different surgical methods are used, they rely on the principles of either growth acceleration or growth retardation, across one side of the physis.

Indications for surgical intervention include deformities that are nonresponsive to conservative treatment, deformities which are progressive with age, or severe in young animals. Surgical intervention is relatively infrequently required but when necessary this must be performed in a timely fashion. As a guide, surgical intervention should ideally be performed for fetlock deformities before 2 months of age and carpal and tarsal deformities before 6 months of age.

**Growth acceleration**

**Periosteal strip (hemi-circumferential periosteal transection and elevation)**
This technique strips off the outer (periosteal) covering of bone adjacent to the growth plate, accelerating growth on the operated side. Over-correction does not occur with this technique, although its efficacy has been questioned (Sloane et al. 2000), and certainly it does not produce results as dramatic as the retardation techniques.

**Growth retardation (transphyseal bridging)**
Different techniques are available for bridging of the physis. Each technique has different advantages and disadvantages. All require a second surgery to remove the bridge once the deformity has been corrected. When selecting the method to be used, efficacy, complications and cosmetic results all have to be considered.

- **Transphyseal screw**: (Witte et al. 2004; Kay et al. 2005; Roberts et al. 2009). Probably the most common technique currently employed, the screw is inserted in a neutral fashion, across the physis from proximal to distal, limiting growth on the bridged side. The cosmetic result is usually excellent as the incision is very short. Surgical time is also reduced compared to other techniques, and improvements in angulation have been reported to be both greater and occur at a faster rate. In occasional cases over-correction has been seen after screw removal.

- **Screws and wires**: (Fretz and Donecker 1983). A combination of 2 screws and wires in a figure 8 configuration is also common, particularly at the distal radial physis. This is a slightly more complicated surgery and cosmesis is not as good. However, the technique avoids bridging through the physis, so over-correction after implant removal should not occur.

- **Staples**: (Heinze 1963). Physeal stapling has become much less commonly employed in recent years. Compared to the above techniques staples offer a lesser degree of correction, achieved at a slower rate) and a larger incision is required, compromising cosmetic outcome.
Further reading

NOTES

Saturday 11th September 2010