

Conformation and Foot Disease in Beef Cattle

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Although the prevalence of lameness in beef cattle herds is variable, more than 75% of these lameness occur in the foot (1). Australian surveys show that lameness and overgrown feet are responsible for between 4% and 7% of the wastage in beef cattle (3). On many properties very little attempt is made to trim the feet because cattle grazing pasture normally wear the hoof walls and soles to such an extent that additional foot care is unnecessary.

Cattle should stand squarely on all four feet and retain this conformation throughout a normal life span. Limbs need to support the body weight without placing undue stress on the joints, muscles, ligaments and tendons (1). Poor conformation of the limbs may cause the development of arthritis or be responsible for abnormal hoof wear. Alternatively an abnormal stance may develop as the result of a hoof lesion. While limbs, especially hind limbs of good conformation are correctly considered important in selection, it is difficult factually to relate bad limb conformation to specific foot diseases (6).

Recognised normal limb conformation in cattle has been described (6), (Figure 1). In the hind limb the normal caudal angle of the stifle ranges between 120° and 134°. This angle is similar to the dorsal angle of the hock. When cattle are standing evenly on all feet the *tuber calcanei* are vertically below the *tuber ischu* both in the lateral and the sagittal planes.

Cattle with straight hind limbs have the angle of hock increased up to 170°. Straightening of the hocks is a tendency frequently seen in bulls and older cows. A decreased angle of hock (sickle hock) is more apparent in housed cattle and cattle affected by poor nutrition. 'Cow-hocked' cattle, or cattle with the hocks more medial than normal, are prevalent in mature cows with a pendulous udder.

The metatarsus which normally rests at an angle of about 79° to the horizon, forms a dorsal angle of 150° to 160° at the fetlock joint. In the forelimb the metacarpus is almost vertical and the dorsal angle of the fetlock is smaller (140° to 150°). Cattle in which the metatarsal angle to the ground is decreased (i.e. less than 79°), have more weight and pressure on the heel and hoof overgrowth is an inevitable sequel.

Ideally the claws of the hooves are of equal size and placed close together with the toes almost touching, except during weight bearing when they diverge slightly (1, 6). The angle that the dorsal wall of the hooves form with the sole ranges between 45° and 55°. Generally the ground surfaces of the fore claws are larger than those of the hind claws and the lateral hind claw is often larger than the medial claw in many bulls, particularly older bulls, and heavy cows.

The distribution of body weight of cattle is approximately 55% on the fore feet and 45% on the hind feet.

In bulls a very marked weight load occurs on the fore feet whereas in cows especially when pregnant, the weight moves caudally and the hind claws take more weight.

Weight bearing by the hind limbs is primarily on the hips. In the majority of cattle the medial hind claw is directly below this point (6). The lateral digit and claw bears less weight and is subject to abnormal growth as a result. Therefore overgrowth commonly results in horn of the lateral digit being curved forward and upward. However, cattle which have adopted the cow hocked stance with the lower limbs abducted, may carry up to 70% of the weight of each leg on the outer claw (5).

The distal border of the abaxial wall together with the heel along with the axial wall dorsal to the axial groove are the main weight bearing parts of the hoof (6, 8). The sole is slightly concave (Figure 2). The claws need to be straight enough for the hoof wall to bear weight and the heel deep enough to reduce concussion. A shallow heel is more prone to bruises and penetration by foreign bodies. When moving the areas of greatest concussion on impact would seem to be the dorsal part of the heel in the case of the hind foot and the region of the toe in the fore foot (6) (Figure 3).

Three particular structures of the bovine foot are now considered:

1. The wall of the hoof
2. The sole
3. The interdigital space.

1. The wall of the hoof

Normal horn growth of the hoof wall averages between 0.5cm and 2cm per month which with variations total approximately 6cm per annum. The horn growth is more rapid near the heel than at the toe and faster in the abaxial wall than the axial wall (6).

Sandcracks, especially those occurring on the dorsal wall of the hoof are most frequently seen in the fore feet. When walking the bull places the toe of the fore foot on the ground first and the weight is therefore borne in the dorsal region resulting in damage and splitting of the horn (1, 6).

Many cattle are lame because of improper hoof care. When the horn is allowed to grow a number of conditions which cause lameness may develop (1), viz:

- a. There is breaking of the horn at the toe.
- b. Undue stress is placed on the weakest part of the sole resulting in a sole ulcer.
- c. The lateral wall curls under the sole and affects the functioning of the foot.
- d. The animal's weight is greater on the heel and places undue stress on the fetlock and pastern joints.

- e. The posterior surface of the heel develops cracks which are foci for infection.

In many instances the normal functioning of the foot can be restored by proper foot trimming.

2. The sole

Injuries to the sole are frequently related to the amount of horn wear. Excessive wear especially in the region of the point of the toe, and the abaxial hoof wall causes separation of the thin sole at the white line (6). The condition is seen in young cattle forced to walk long distances over hard ground or concrete yards, or grazing wet and irrigated areas (7).

When the foot constantly rests in moist conditions the horny layer of the sole becomes excessively soft. The hardness and elasticity of the corium depends on the water content of the sole tissue remaining between 15% and 25%. There is an additional uptake of water of 5% when cattle stand for prolonged periods in water or faeces causing a subsequent softening of the sole which disquamates and ulcerates (5).

Ulceration of the sole occurs particularly at the junction of the sole with the horn of the wall at the axial groove. Haemorrhage and necrosis in the keratogenic membranes of the area causes the underlying tissue to be unprotected and granulation to occur. Although all types of cattle are affected ulceration is more prevalent in the heavier breeds. Because of weight distribution bulls are likely to be affected on the fore feet and cows on the hind feet (1). Often there is a bilateral effect, e.g. the medial claws of both fore feet are affected.

In the hind foot a significant difference in the bone structure is seen in the position of the bearing surface of the third phalanx in the outer claw compared with other claws. While the body weight is taken more or less on the abaxial margin of the medial bone, the lateral pedal bone stands more on the sole and axial margin (4, 10). This disposition of the third phalanx is present in the majority of cattle and is believed to be an important factor in the aetiology of sole lesions.

Because of this positioning of the hind feet the solar horn of the lateral claw frequently extends over the axial border, while the abaxial wall is up to 3cm greater in depth than the same area of the medial claw. The weight bearing surface is no longer perpendicular to the metatarsal bone and greater stresses are placed on the solar surfaces of the lateral claws (10).

3. The interdigital space

Conformation plays an obvious part in predisposing the interdigital space to trauma and infection. Cranially the skin is loose and folded allowing the claws to part on weight bearing. Between the heels and digital cushion the skin is more firmly attached (9).

Trauma to the interdigital space can cause severe injury depending on the direction and extent of penetration. The vulnerable points are the dorsal extremity and the middle third of the area, which are the sites for approximately 40% of all penetrations to the foot (9). The chances for damage are also increased in cattle which have acquired low heels, or a decreased angle of the fetlock joint transferring more weight to the heels.

The incidence of interdigital space hyperplasia in beef cattle is high. Although slight signs may be seen in

younger cattle, hyperplasia can become severe as the cattle grow older, and a lameness develops (2). An inherited predisposition is a possibility, but larger cattle are more prone to the problem (1).

Interdigital skin hyperplasia is a ventral outpouching of the interdigital fat, followed by thickening of the skin. As the mass projects downwards it is compressed between the claws and irritated by contact with the ground and foreign objects. This continual irritation stimulates further enlargement and walking becomes painful (9). The pain may be particularly evident when the bull mounts and all his weight is on the hind toes resulting in considerable stretching of the cranial part of the interdigital space.

Splay feet (or splay toes) with digits more widely angled than usual have been shown to be associated with interdigital skin hyperplasia. There is no certainty that hyperplasia develops because of the stretching of the interdigital and cruciate ligaments (9).

Between the heels any swelling in the interdigital space can lead to erosion of the surface, soreness and pain and under-running of the horn towards the sole-heel junction.

Foot deformities frequently result in compression lesions in tissues not adapted to support pressure (4). Many result from chronic laminitis. Others may be hereditary, e.g. corkscrew claw, or present at birth e.g. deviated and twisted claws and become more evident as the animal grows older (1). Although the shape of the claws can be improved by constant trimming it can never be completely corrected because of the skeletal structures becoming deformed.

In the selection of beef cattle, conformation is a factor to consider for the prevention of foot disease. It is most important that the body weight is evenly distributed and limited to those parts of the foot which are adapted for the purpose.

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