

UNDERSTANDING LAMENESS IN DAIRY COWS

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INTRODUCTION

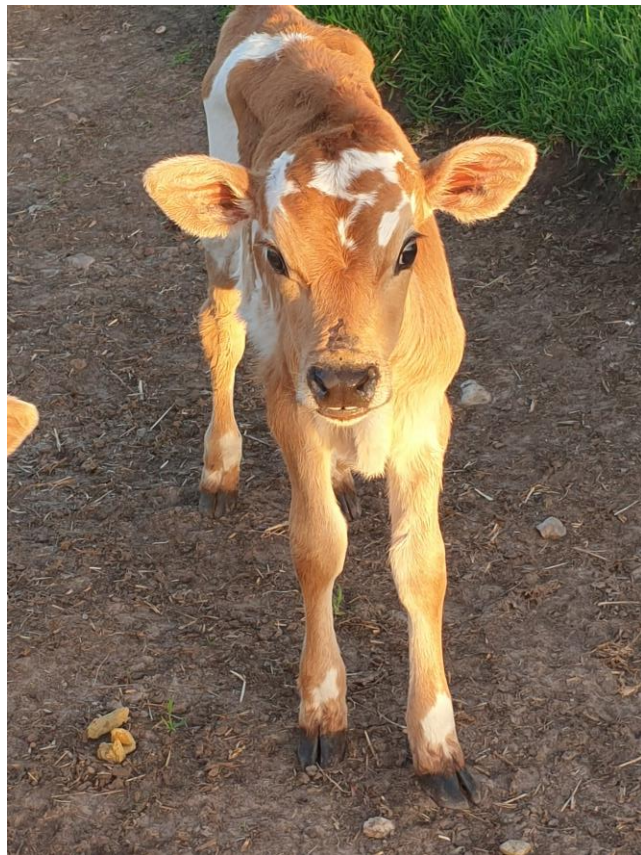
- Lameness is the third most common cause of production and financial losses on a dairy farm after mastitis and fertility issues
- Why is the same amount of effort and expenditure not spent on lameness as is spent on fertility and mastitis?
- A number of studies have shown that farmers significantly underrate lameness.

LAMENESS HAS NEGATIVE EFFECTS ON PRODUCTION



- Increased lying times
- Increases the risk of developing mastitis. Especially if they lie down too soon after milking.
- Cows will lay down at the cost of other activities such as eating or moving around to find better grazing.
- This in turn leads to weight loss, lack of weight gain and negative energy balance.
- The reduction in dry matter intake results in a reduction of milk production
- Can be as much as a 20% reduction in severely lame individuals

LAMENESS HAS NEGATIVE EFFECTS ON FERTILITY



- Cows less willing to stand and be mounted
- Pain causes cortisol level increase and influences the hormonal cycles
- Coming into heat later
- Not coming into heat at all
- Increased incidence of cystic ovaries
- Failure to fall pregnant
- Extended calving to first service interval
- Extended calving to conception interval - conception rate is lower in lame cows at first service, with a lame cow taking on average 28 days longer to become pregnant.
- Clinical lameness in the first 70 days in milking reduces pregnancy by up to 25%

LAMENESS HAS DIRECT COST IMPLICATIONS

- Cost of drugs and labour to treat cows
- Milk withdrawal periods while cows are being treated
- Reduced milk production. The reduction in milk production usually happens before lameness is even diagnosed
- High producing cows are more likely to become lame making the loss in production even more severe
- Culling animals in severe cases



Photo courtesy of Dairy Smid Hoof Trimming

LAMENESS HAS POSSIBLE ENVIRONMENTAL IMPLICATIONS

- More than 90% of products used in a claw bath or mat, ends up in the manure pit and ultimately on pastures where it affects the micro-organisms in the environment
- Formalin has recently been declared carcinogenic
- Copper sulphate in hoof baths has largely been banned in Europe because it is harmful to the environment.
- Increased antibiotic use
 - greater chance of environmental contamination
 - antimicrobial resistance



THE 90:90:90 RULE

- 90% of lameness occurs in the hoof
- 90% of those lameness occurs in the hind feet
- 90% of those lameness occurs in the outer claw

- The hind feet are used for propulsion = more force
- Cows look where they place the front feet. The back feet track the front feet.



BE CAREFUL! – make sure that you always check all the legs for lameness. A cow may have more than one lesion causing lameness.

LAMENESS CATEGORIES



Photo courtesy of Dairy Smid Hoof Trimming

- **Hoof lesions**
 - Solar ulcers
 - White line disease
 - Abscesses
 - Thin soles
 - Injury, penetrating wounds
- **Skin lesions**
 - Digital dermatitis
 - Interdigital growths
 - Footrot
 - Hairy warts
- **Non-foot lameness**
 - Bone lesion or fracture
 - Muscle injury
 - Joint damage
 - Viral disease – 3 Day stiff sickness

COMMON CAUSES OF LAMENESS

- **Hoof lesions**
 - Usually the result of pressure and shearing forces
 - Check surfaces
- **Skin lesions**
 - Usually the result of
 - excess moisture
 - Poor hygiene (mud, dung and urine)
- **Non-foot lameness**
 - Poor handling of animals by staff
 - Poor handling facilities



DIGITAL DERMATITIS

- Infection and inflammation of the skin above the hoof or between the toes
- Usually the result of unhygienic and/or wet conditions
- Includes Footrot



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Photo courtesy of Dairy Smid Hoof Trimming

SOLE HAEMORRHAGE AND ULCERATION

- Happens when horn production by the corium is interrupted
- The pedal bone puts pressure on the corium towards the back and inside of the claws
- More pronounced in the outer claw
- Arrow indicates haemorrhage in the sole
- The sole becomes thin and eventually forms an ulcer



Photo courtesy of Dairy Smid Hoof Trimming

Sole hemorrhage circumscribed (SHC)

Clear differentiation between discolored and normal colored horn

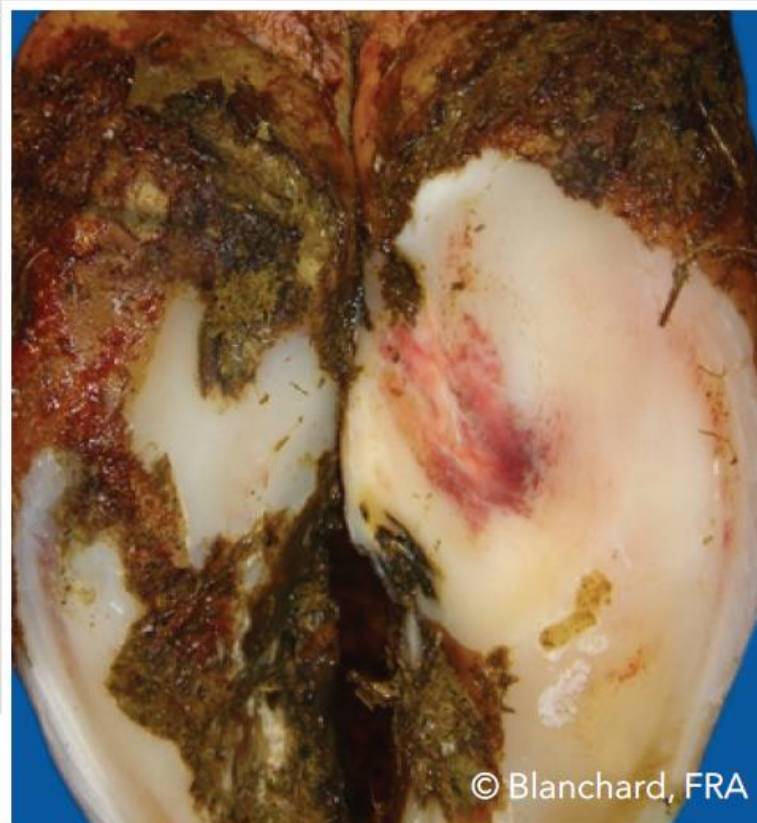


Photo from ICAR Claw Atlas – 2nd Edition

Sole hemorrhage diffused (SHD)

Diffused light red to yellowish discoloration



Photo from ICAR Claw Atlas – 2nd Edition

Sole ulcer (SU)

Penetration through the sole horn exposing fresh or necrotic corium

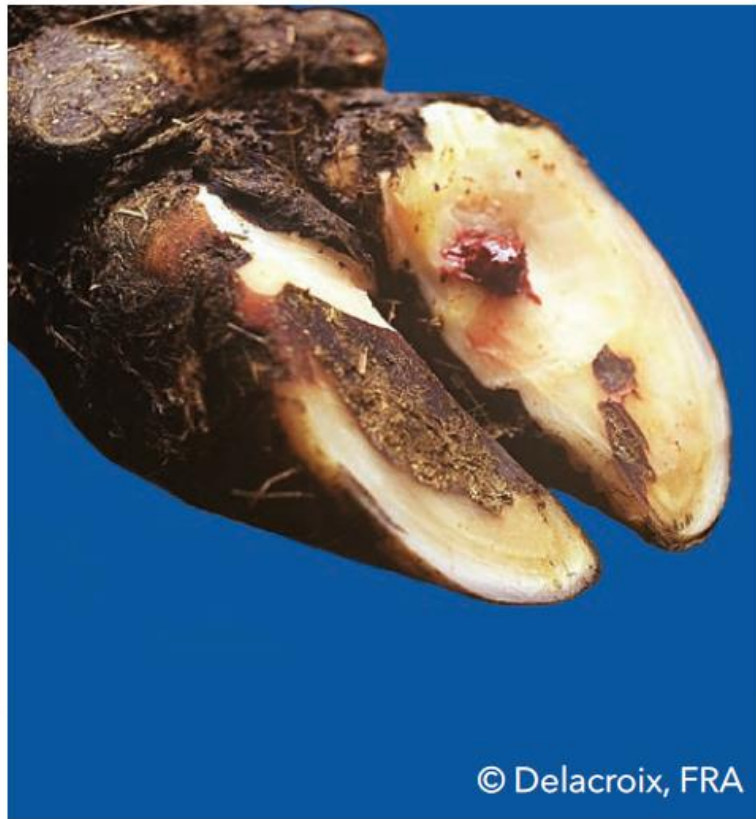
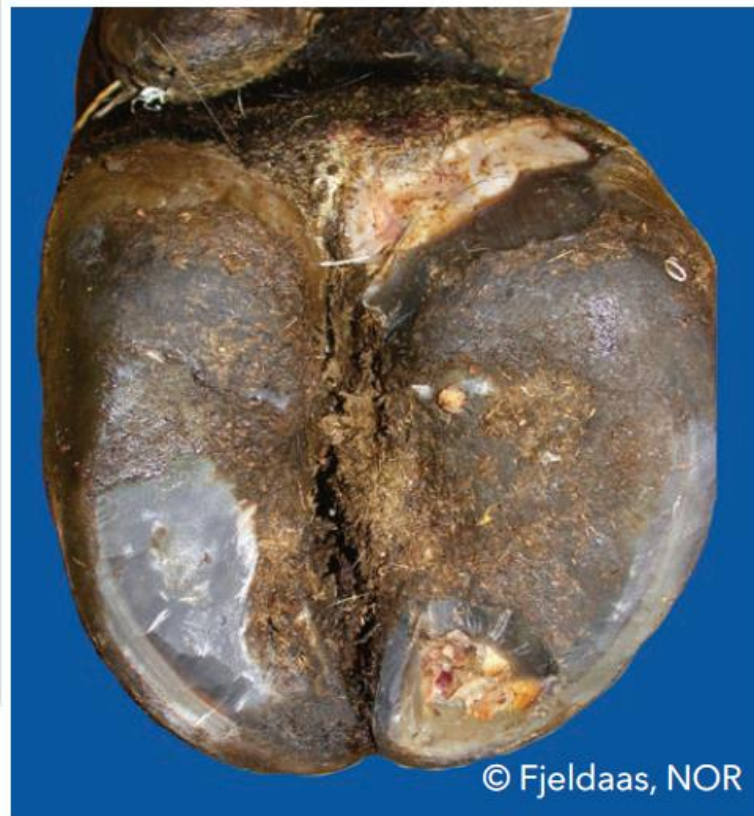


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Toe ulcer (TU)

Ulcer located at the toe



WHITE LINE DISEASE AND ABSCESSSES

- The white line is weaker than the horn of the hoof or sole
- Shearing forces – when animal turns while weight bearing on the foot – can tear the white line
- If bacteria get in it can lead to infection and abscess

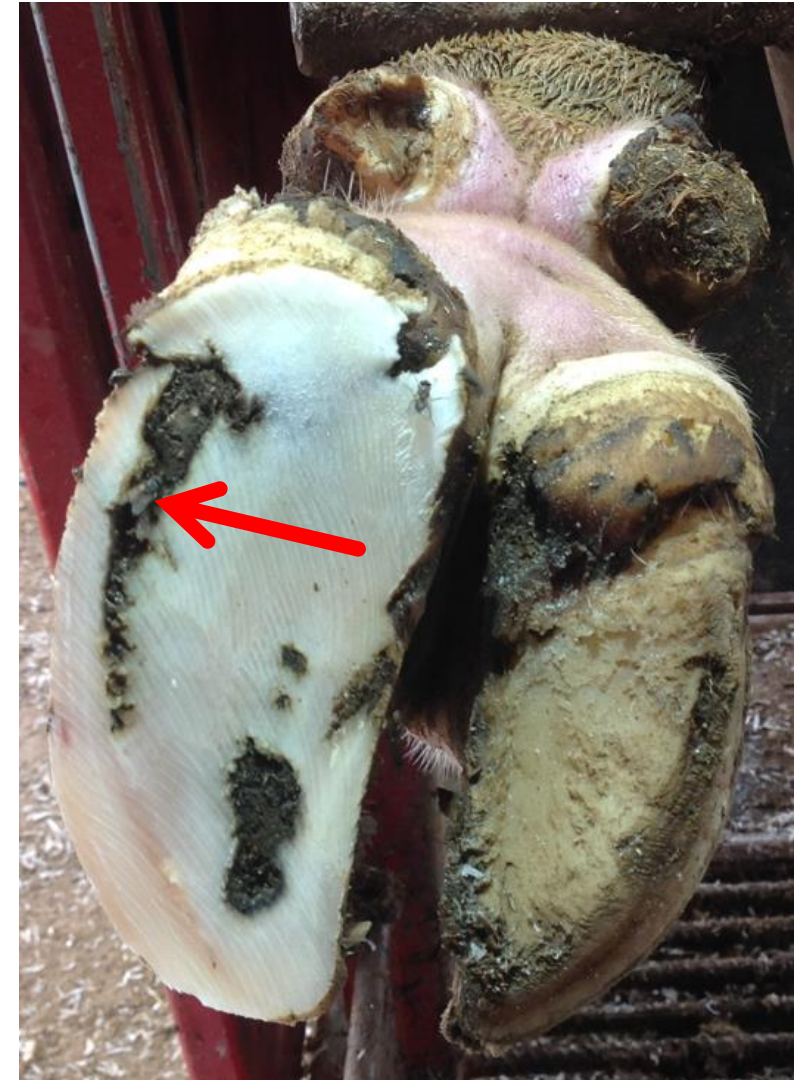


Photo courtesy of Dairy Smid Hoof Trimming

THIN SOLE

- Cause is uncertain
- Leads to varying degrees of lameness and sole haemorrhaging
- Most likely caused by under production of the sole horn
- Could also be caused by cows walking long distances to grazing
- Freshly laid rough concrete has also been implicated
- Diagnosed by pressing the sole to see if it is too flexible

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Thin sole (TS)

Sole horn yields (feels spongy) when finger pressure is applied

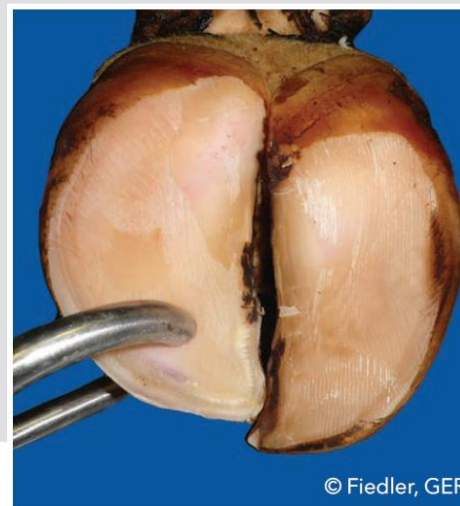


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PREGNANCY

- Hormonal changes around birth causes the collagen fibres in ligaments to relax to allow the pelvis to stretch. This affects all ligaments in the body including the laminae of the hoof
- The pedal bone can rotate easier and cause sole haemorrhage or ulcers
- Damage occurring at this time will sometimes only show lesions and lameness several weeks later since it takes long for the hoof to grow out
- Heifers that go lame in their 1st lactation is 3 times more likely to develop lameness in her 2nd lactation
- Body condition loss also leads to thinning of the digital cushion



HORIZONTAL CRACKS

- Inflamed or infected coronary band
- Nutritional deficiency
- Pregnancy causing temporary nutritional deficiency
- Hoof production was substandard and causes a weak line in the hoof wall
- Sometimes only shows up as horizontal lines in the hoof wall
- Can take up to 4 months to grow out



Photo courtesy of Dairy Smid Hoof Trimming

VERTICAL CRACKS (SANDCRACKS)

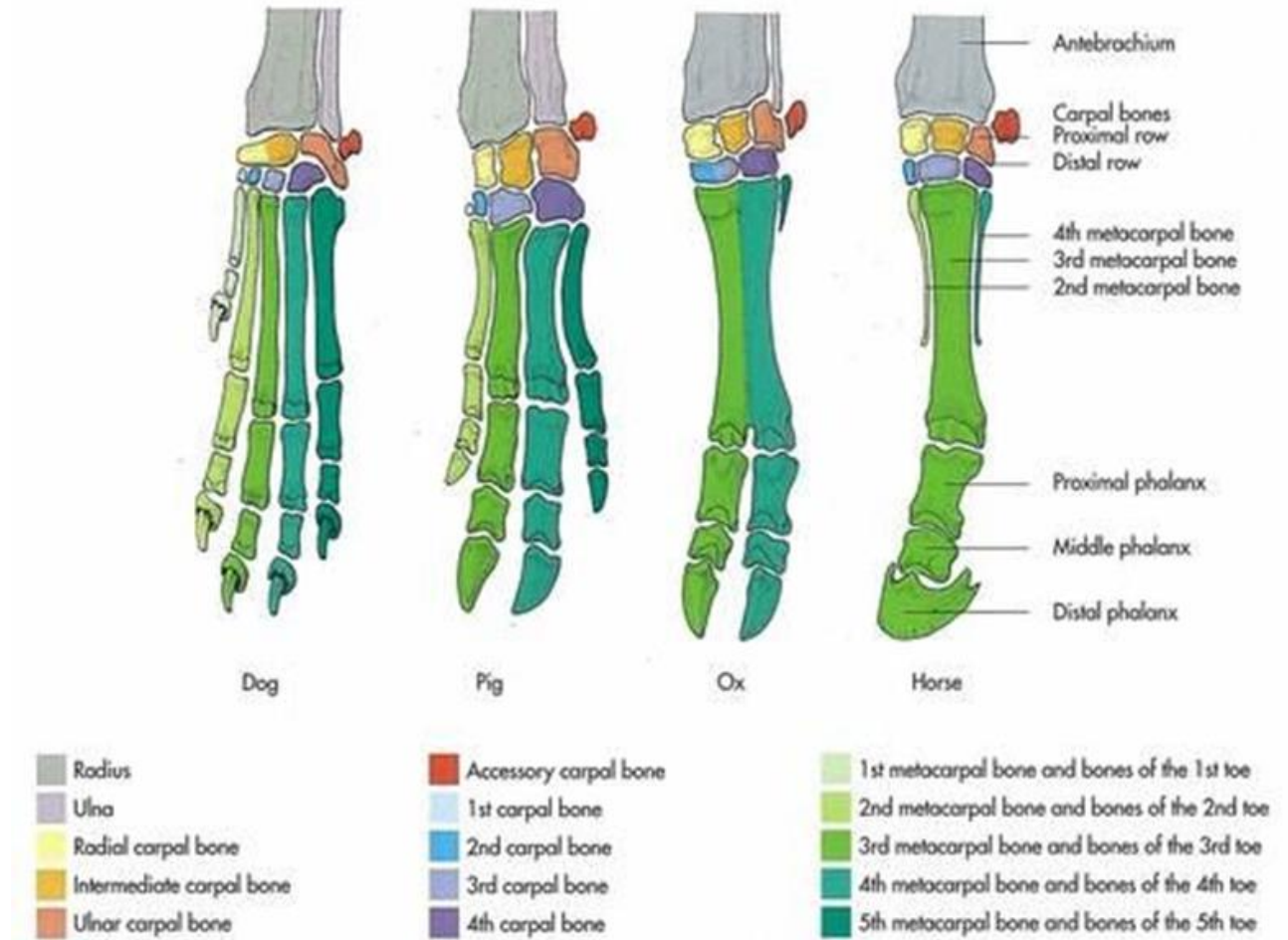
- Cause is uncertain
- Nutrition seems to play a role
- Biotin supplementation helps to harden hoof wall
- Sulphur amino acids – methionine & cysteine
- Fatty acids – linoleic & arachidonic acid
- Minerals – Calcium, Zinc, Selenium,
- Vitamins



Photo courtesy of Dairy Smid Hoof Trimming

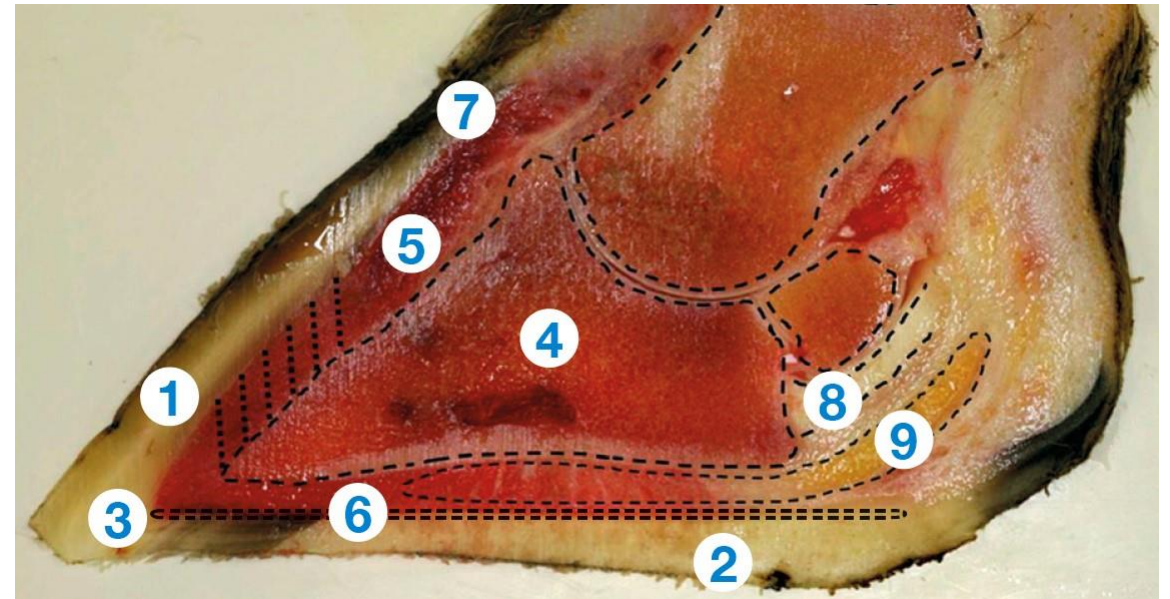
HOOF ANATOMY

- Similar to the last 3 digits of human finger or toe
- The claw is an adapted nail that covers the last digit
- In a cow the toes are the same as the human middle finger and ring finger



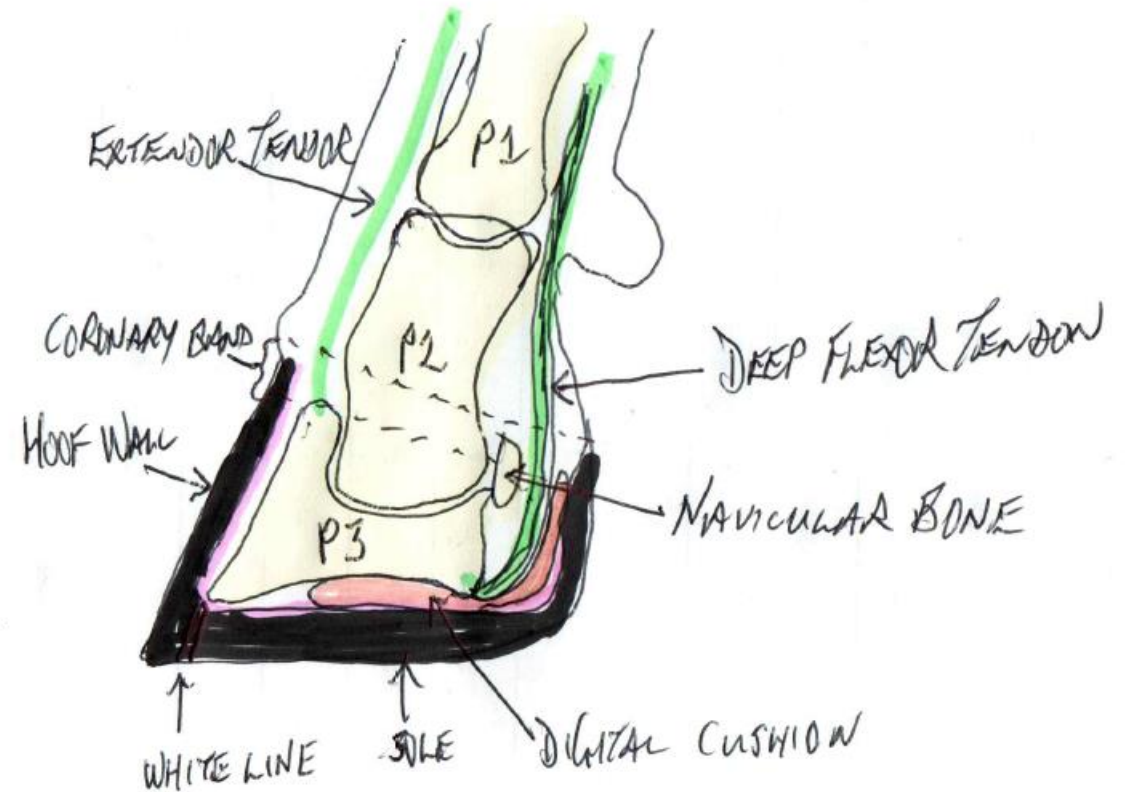
HOOF ANATOMY

- 1 – Horn of hoof wall
- 2 – Hoof sole
- 3 – White line
- 4 – Pedal bone (P3)
- 5 – Strong collagen attachments that anchor the pedal bone to the hoof wall - laminae
- 6 – Thin germinal layer of the corium that produces the sole – only 1-2mm thick
- 7 – Coronary band that produces the hoof wall
- 8 – Deep flexor tendon attaching to the flexor tuberosity of the pedal bone
- 9 – Digital cushion – only 5-7mm thick

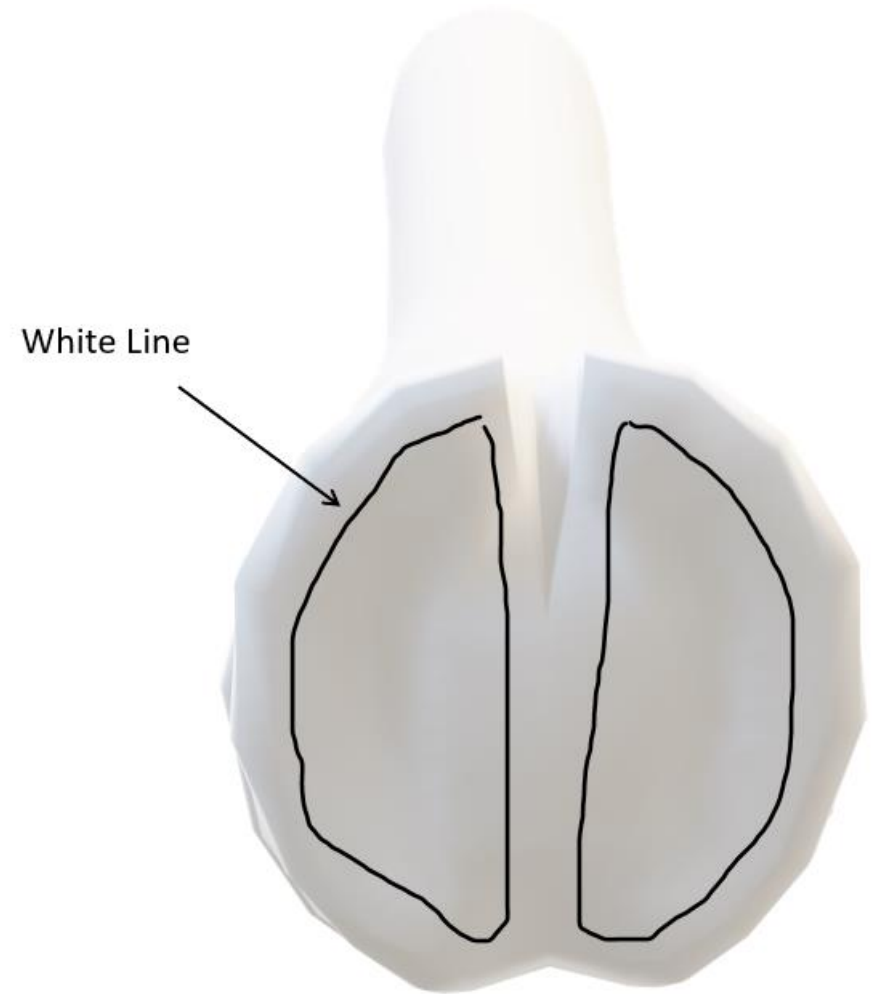
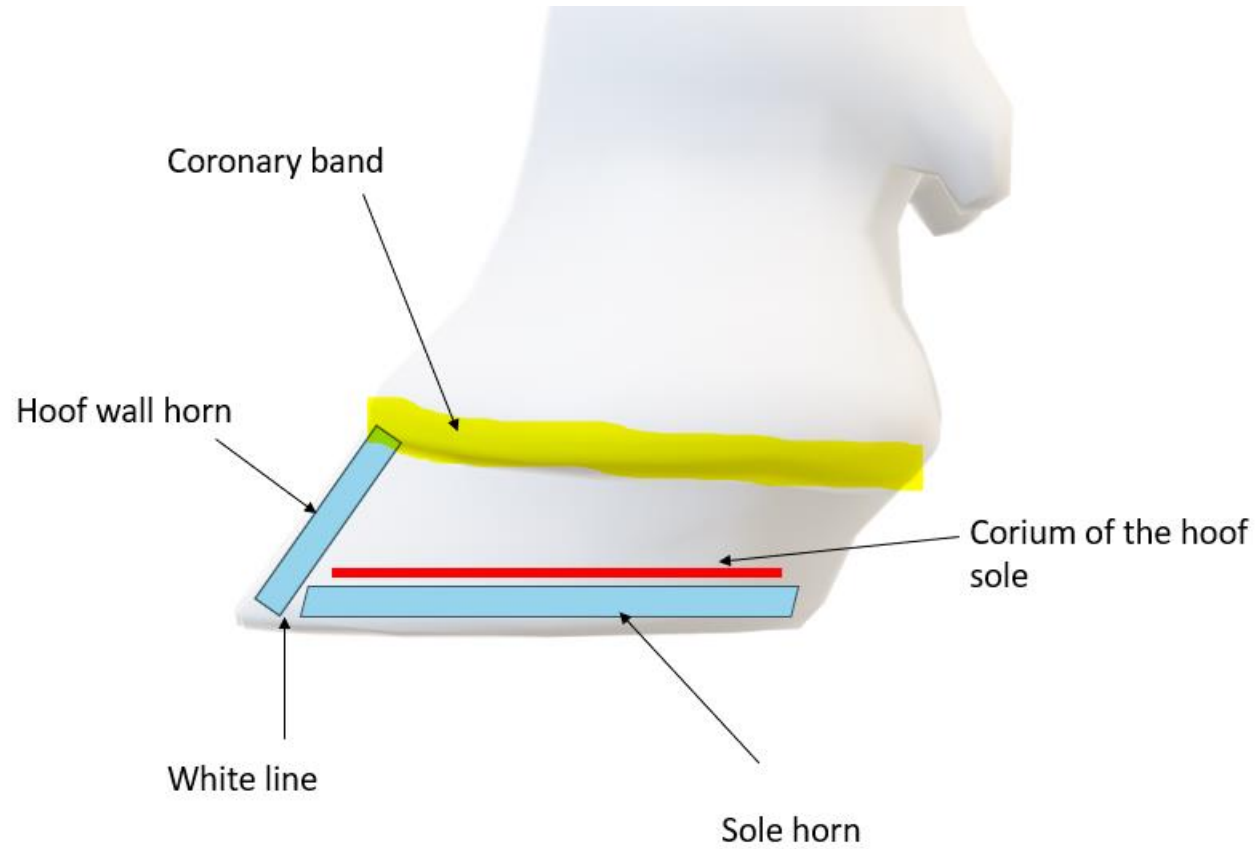


HOOF ANATOMY

- New hoof horn grows from the coronary band towards the sole
- New hoof is formed at the rate of approx. 5-6mm a month
- Takes approx. 12 - 16 weeks for new hoof wall horn to reach the sole
- The sole is produced by a 1mm thick layer of germinal cells in the corium under the toe
- The white line is formed where the hoof wall and the hoof sole meet
- The digital cushion dissipates pressure

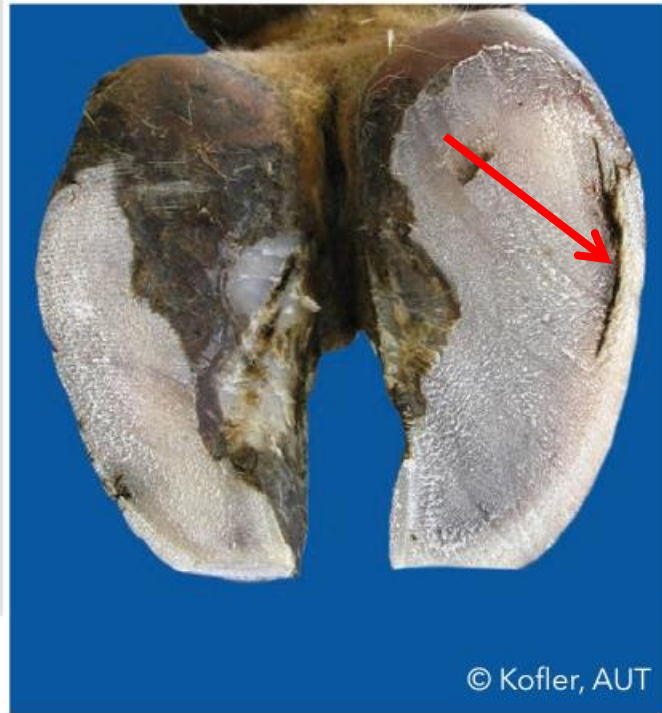


HOOF ANATOMY



White line fissure (WLF)

Separation of the white line which remains after balancing both soles



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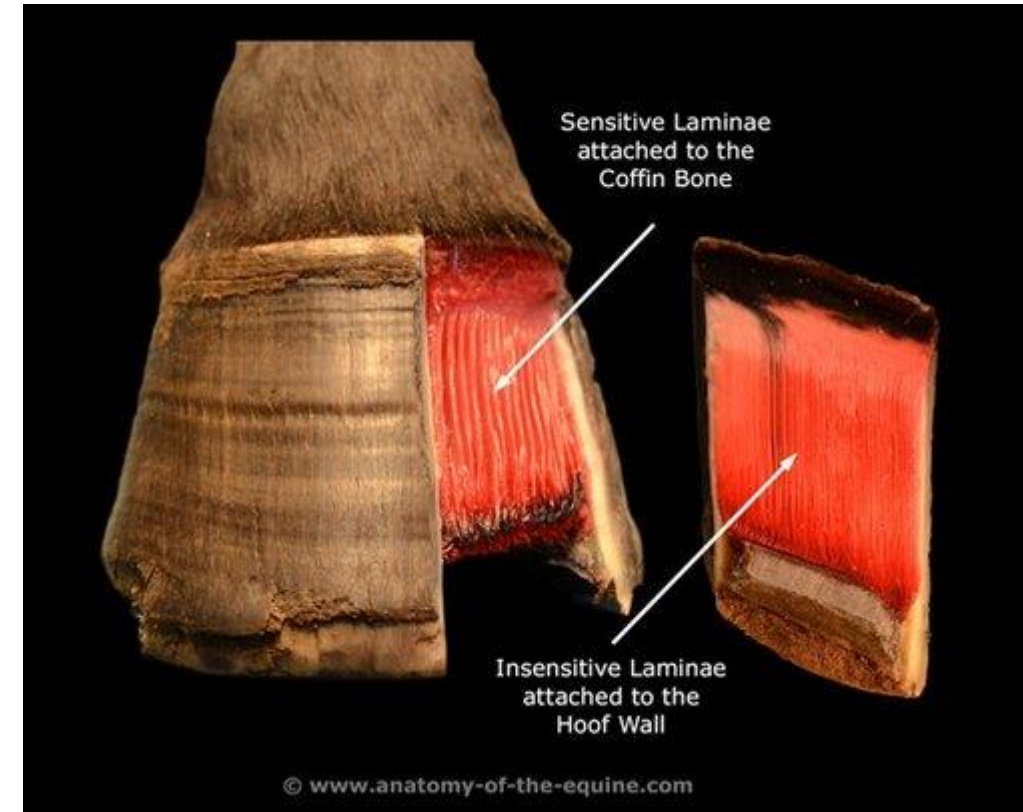
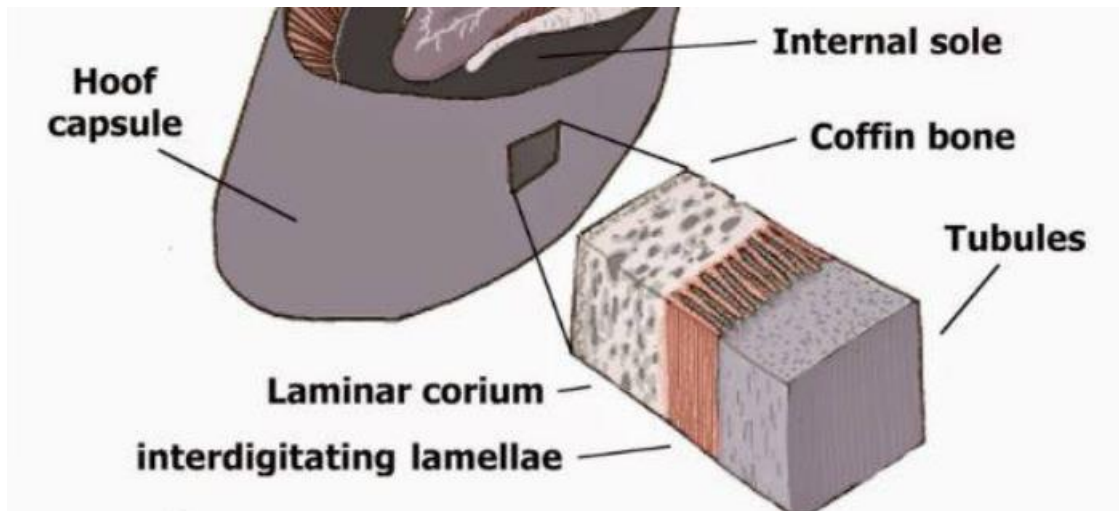
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HOOF ANATOMY - LAMINAE

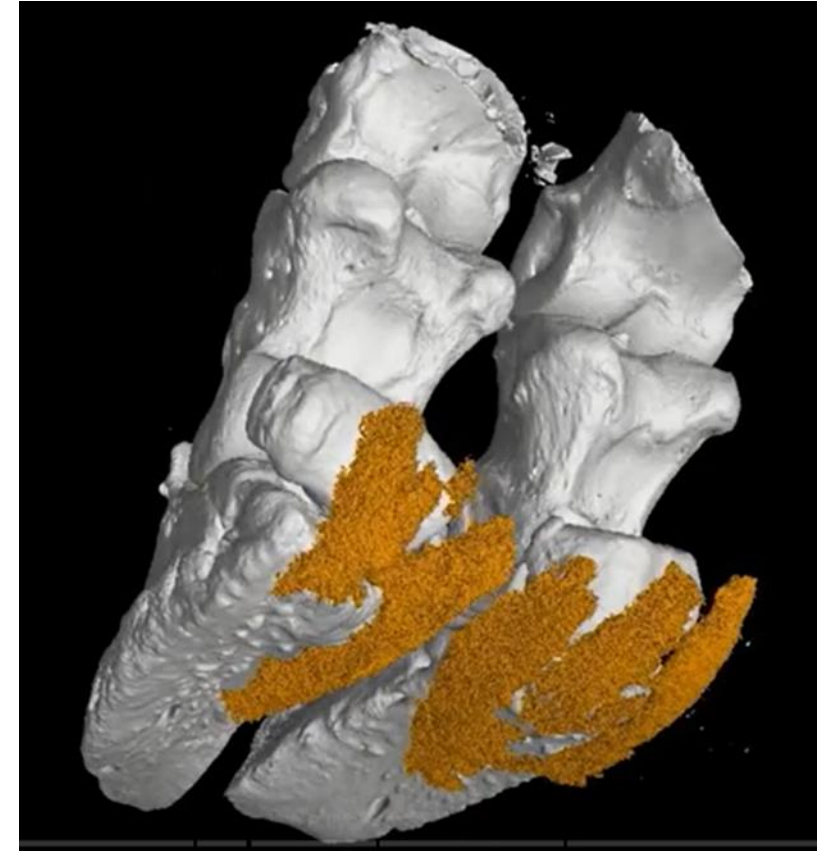
- The hoof wall is attached to the pedal bone by collagen fibres arranged in fins called laminae
- Laminae interlink like the fingers of your hands to form an extremely strong bond
- If these laminae become inflamed it is called laminitis
- Laminitis is a painful condition



Pictures of a horse's hoof to illustrate the laminae

HOOF ANATOMY - DIGITAL CUSHION

- A layer of fat between the sole and the pedal bone
- Spreads the pressure on the heel evenly
- If a cow loses weight, this fat pad becomes thinner and the pedal bone can bruise the sole easier.
- A thinner pad leads to more pressure on the germinal layer. Especially at the flexor tuberosity
- The blood supply also gets pinched easier
- If the germinal layer is damaged it bleeds – causing sole haemorrhage
- If completely damaged, it stops producing sole horn and an ulcer forms



The Digital Cushion – Scarring and loss of function

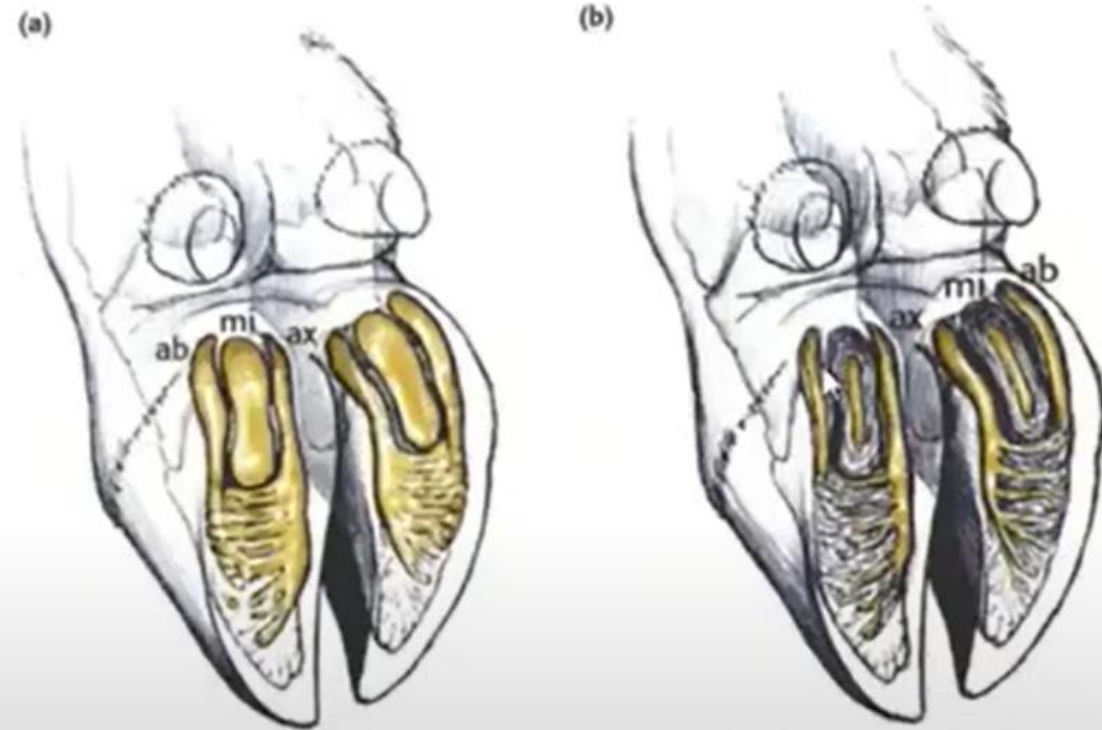
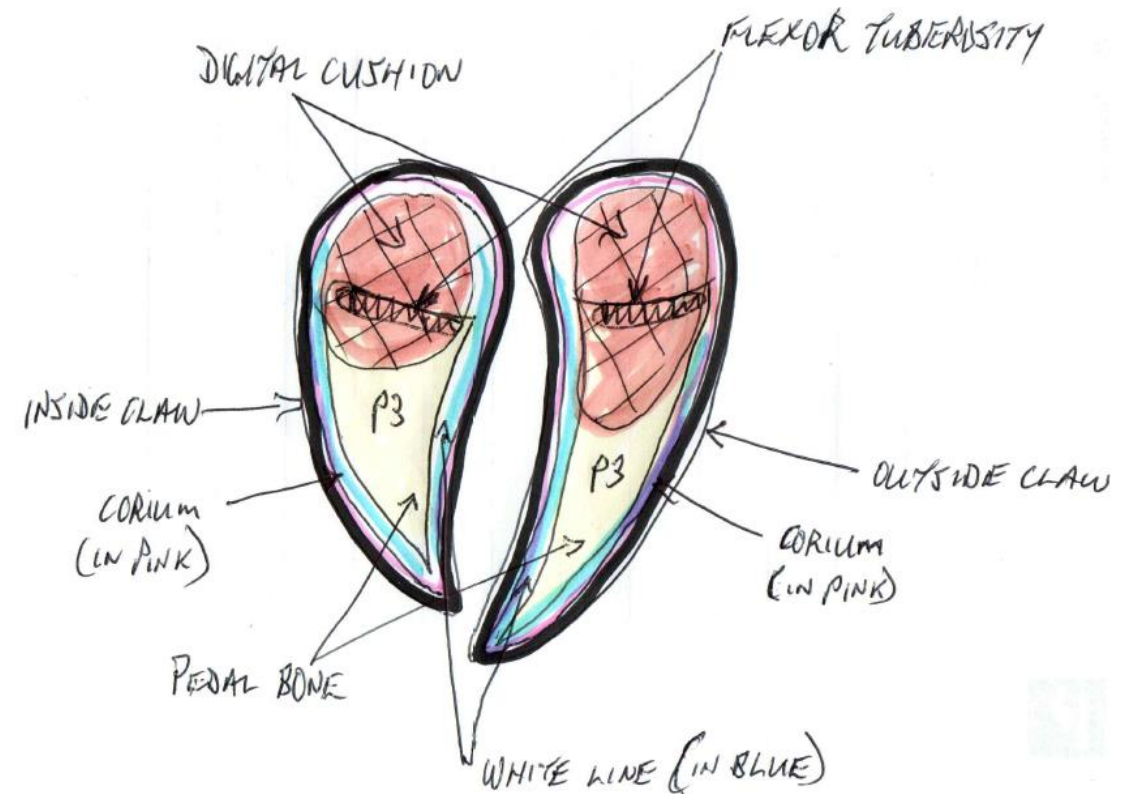


FIG 1: Claws of (a) a normal hind foot and (b) a right hind foot with a sole ulcer showing the shape and size of the fat cushions under the pedal bone. The horn capsule and corium have been removed. The fat bodies of the cows with ulcers had significantly less yellowish fat and more connective tissue than the control cows. ax Axial, mi Middle, ab Abaxial fat cushion

Ch Lischer et al (2002). Veterinary Record 151, 694-698

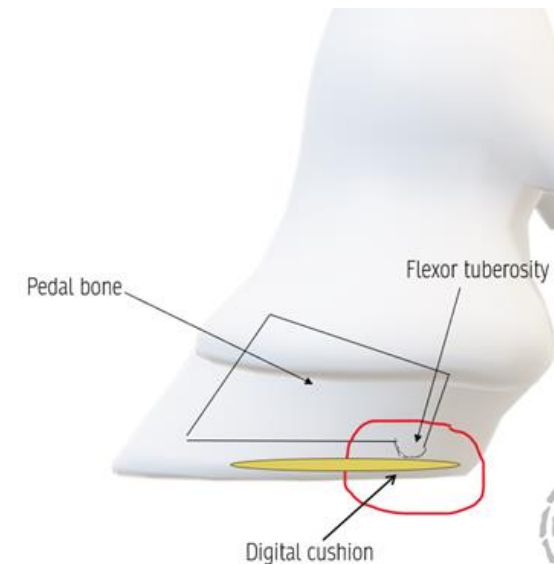
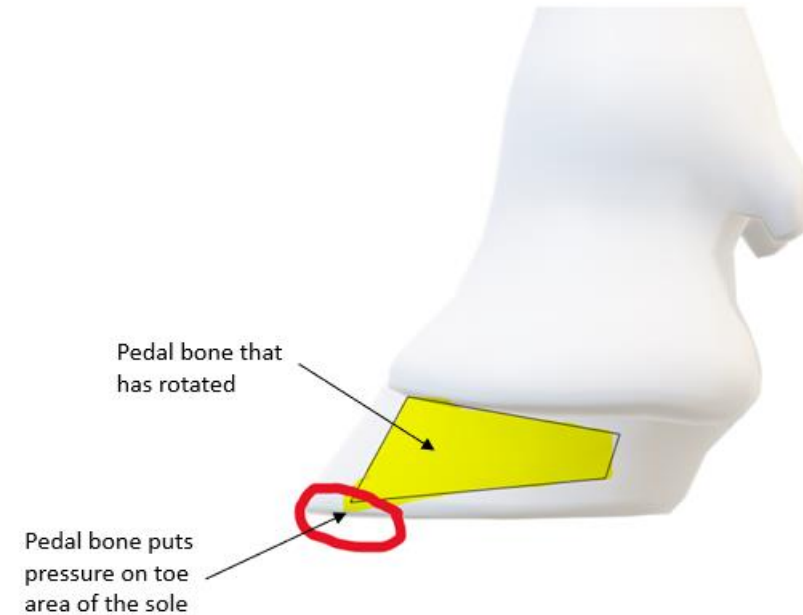
HOOF ANATOMY – HOOF SOLE

- Lameness leads to extra bone formation on the pedal bone.
- This put more pressure on the digital cushion leading to scarring
- This causes less weight dissipation
- More pressure on the germinal layer of the corium leading to bleeding and ultimately death of the hoof sole and ulcers
- This is a vicious cycle of events that progressively gets worse
- Important to catch them at the first signs of lameness to prevent the downward spiral of severe lameness



SOLE PRESSURE POINTS

- If the laminae tear or during pregnancy the collagen fibres become weaker the pedal bone could rotate
- This puts pressure on the sole in the toe area eventually leading to toe ulcers
- If the digital cushion loses fat and becomes thinner the pedal bone puts more pressure on the corium of the sole
- Especially below the deep flexor tuberosity. Leading to heel ulcers





© Thomas & Prodhomme, FRA

Heel ulcer



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Toe ulcer



DIFFERENT FARMING SYSTEMS REQUIRE DIFFERENT APPROACHES



TMR – open camps



Pasture based



TMR barn

WALKING SURFACE AFFECTS LAMENESS

GRASS & SAND

- Hard and abrasive surfaces cause most bovine lameness.
- Grass is the optimal surface
- Sand is the best natural alternative.



RUBBER

- Rubber is good, but cows are not confident on rubber surfaces due its slippery nature.



GRAVEL WALKWAYS

- One of the most common materials for walkways
- Needs to be smooth and not full of large stones
- Must have proper camber to prevent water stagnating on the surface
- Clean when needed.



TAR (ASPHALT)

- Tarred (asphalt) surfaces are highly abrasive and not recommended.



CONCRETE

- Used for the farmer's convenience, not for the cow's convenience
- Concrete is the most used type of surface in livestock management due to its long-term durability and ease of cleaning. However, the highest prevalence of lameness occurs on this surface.



STANDING TIME AFFECTS LAMENESS

- Given a choice, cows will avoid wet and dirty surfaces.
- Cows are highly motivated to lie down. It is an important aspect of dairy cow welfare.
- The risk of lameness is increased in unfavourable conditions for cows to lie down and where cows are forced to stand. Due to impaired blood flow to the hooves.
- Time constraints, such as feeding or milking, can also influence lying time.
- Cows show rebound lying behaviour after periods of forced standing and will sacrifice other activities, such as feeding, to lie down for an adequate amount of time.



STANDING TIME AFFECTED BY SURFACE



AVOID THIS



DETECTING LAMENESS

- Farmers have been reported to underestimate the prevalence of lameness in their herds
- Due to farmers' perception of the importance of lameness
- Time and skill required to perform locomotion scoring.
- Will normally only pick up the really bad cases and are unable to detect small changes in gait.
- Regarding only severely lame cows as those requiring treatment
- Cows are stoic animals that may hide low levels of pain. This contributes to the presence of painful claw lesions in cows without eliciting clinical lameness



LOCOMOTION SCORING

- Seen as the gold standard
- Cheap to implement. No special equipment required
- Needs training and practice
- Appoint a dedicated person to perform locomotion scoring
- The main disadvantage of manual locomotion scoring is its subjectivity and low sensitivity.
- 2 experts scoring the same videos of lame cows differed 43% of the time on the level of lameness. However, when they only had to determine whether an animal is lame or not, the level of correlation increased substantially.






| | Lameness score | Clinical description | Assessment criteria |
|--|----------------|----------------------|---|
|  | 1 | Normal | The cow stands and walks with a level-back posture. Her gait is normal. |
|  | 2 | Mildly lame | The cow stands with a level-back posture but develops an arched-back posture while walking. Her gait remains normal. |
|  | 3 | Moderately lame | An arched-back posture is evident both while standing and walking. Her gait is affected and is best described as short-striding with one or more limbs. |
|  | 4 | Lame | An arched-back posture is always evident and gait is best described as one deliberate step at a time. The cow favors one or more limbs/feet. |
|  | 5 | Severely lame | The cow additionally demonstrates an inability or extreme reluctance to bear weight on one or more of her limbs/feet. |

Figure 1: Locomotion Scoring System, table adapted from SPRECHER *et al.* (1997)

TREATMENT

- **Treat all lameness cases aggressively with combination treatment of a therapeutic trim, hoof block and pain relief.**
- **REST – Keep cows close to parlour**
- When cows have been lame for six weeks or more prior to treatment, overall cure rates were considerably lower than if they had been lame for two weeks or less
- The sooner a cow was treated, the less likely she was to become chronic or require repeated treatments
- Locomotion scoring really Needs to be done every 2 weeks to prevent cases from becoming chronic





Photo courtesy of Dairy Smid Hoof Trimming

HANDY INFORMATION

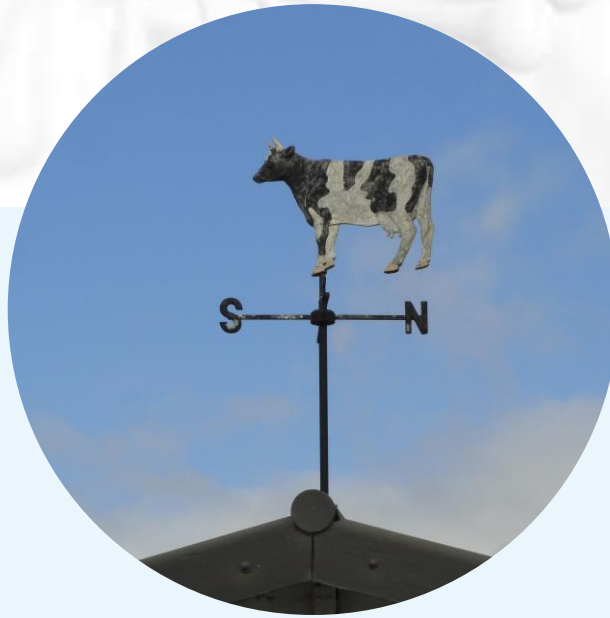
1. <https://www.icar.org/Documents/ICAR-Claw-Health-Atlas-Appendix-1-DD-stages-M-stages.pdf>
2. <https://www.icar.org/Documents/ICAR-Claw-Health-Atlas-Appendix-2-DD-associated-Claw-Horn-Lesions.pdf>
3. [https://www.icar.org/ICAR Claw Health Atlas.pdf](https://www.icar.org/ICAR%20Claw%20Health%20Atlas.pdf)
4. <https://www.icar.org/wp-content/uploads/2016/11/Poster-Claw-Atlas-in-English.pdf>
5. <https://www.youtube.com/watch?v=pa88nfVq6pE> – Dairy NZ Hoof Lameness Scoring
6. www.dairystandard.co.za



TO SUMMARISE

- If you remove all causes of lameness tomorrow, you will still have lameness cases for at least 4 months, and it can take up to 3 years to eliminate problem cows
- Cows with previous injuries will still show lameness as the injured hooves grow out
- Try to determine the major causes of lameness:
 - Skin lesions are generally due to wet conditions and poor hygiene
 - Hoof lesions are generally due to pressure and surfaces
 - White line tears and injuries above the hoof are generally due to poor animal handling and poor handling facilities
- Determine whether these are new cases of lameness or recurring lameness
- Focus on the cause of lameness and not on the treatment





THANK YOU

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