PRE-NAVICULAR SYNDROME

Thesis submitted in part of the requirements for the
Worshipful Company of Farriers Fellowship Examination

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Introduction

Navicular disease in horses is usually diagnosed only when an obvious lameness is present. It is possible, however that a number of clinical signs are evident to the careful observer some 18 to 24 months before the onset of lameness. It is this state that will be referred to as the 'pre-navicular syndrome'.

The almost total reliance on radiographic evidence of areas of radiographic lucency, increase in number, or change in shape of foramina in the navicular bone for the purposes of diagnosing navicular disease often diminishes the prospects of a complete cure, as these are seen in the latter stages of the disease. The subsequent administration of anticoagulant drug therapy (or Isoxsuprine) would seem to be palliative rather than curative - and any improvement temporary - as long as the root mechanical causes are neglected.

Farriers and veterinary surgeons should recognise the signs of change in the horse's behaviour, gait, feet, and shoe-wear to affect an early diagnosis of a developing syndrome. This clinical condition will, if left untreated, develop into navicular disease.

It is my contention that, with intelligent analysis of the signs that are apparent in the pre-navicular syndrome and with the help of regular shoeing to restore the correct mechanical balance of the limbs and feet of affected horses, the development of the syndrome can be prevented and a permanent and effective cure can be obtained.

Etiology

Navicular disease is a chronic progressive forelimb lameness and is the final stage of a clinical syndrome. The majority of horses in Great Britain that exhibit signs within the navicular syndrome seem to share one factor, that of

anterior-posterior hoof-pastern imbalance (broken-back axis), which may or may not be complicated by medio-lateral hoof imbalance.

Under such conditions, greater weight is borne by the caudal parts of the foot, rather than distributed over the entire ground surface of the wall and bars, as it should be. the direct result is that the heels collapse under excessive pressure and become under-run, thus failing to support one foot. Once this process of collapse has begun, it becomes self-perpetuating, as the angle of weight-bearing becomes greater and greater.

In consequence, the structures within the caudal aspect of the foot - the lateral cartilages, digital cushion, navicular bone, deep flexor tendon, blood vessels, and nerves - are all subjected to abnormal stresses and pressures. Passive venous congestion occurs within the foot (Colles 1982), nutrition to the bone in impaired, and, if left unchecked, this condition will lead to arterial sclerosis and thrombosis, with necrosis. Spur formation on the navicular bone may also be noted in radiographs (see fig 1 & 2).

Once the disease has progressed to the stage of producing structural changes in the bone, navicular suspensory ligaments, or deep flexor tendon, it must be considered incurable.

Materials and Methods

The clinical evidence of ten diagnosed cases of navicular disease was catalogued, along with the horses' owners' answers to questions on changes in the horse's disposition and performance level, to establish a control group. (table 1, group a).

The clinical evidence from group was compared to the clinical evidence collected from a second group of ten horses, whose symptoms were similar to that of group a, but who could not be diagnosed as having navicular disease because no radiographic evidence was found. (Table 2 group b). The

symptoms apparent in both groups could not be attributed to any other pathological condition.

It seemed reasonable to assume that the horse in group b were in a pre-navicular condition.

Both groups were treated with corrective farriery with the object of restoring correct foot and limb balance, in addition to any drug therapy that may have been prescribed by the veterinary surgeon, in charge of the case. The effects of this treatment were analysed from January 1985 to July 1986.

Causes

These fall into three main areas;
1) Farriery;
2) Management and Environment;
3) Conformation.

Farriery Causes

1. Failure to recognise, achieve and maintain correct hoof-pastern axis, which will cause the angle of weight bearing to become greater and thus leading to collapse of the heels.

Figure 1 typical long toed collapsed heel hoof conformation of horses presenting with caudal heel pain

2. The failure to achieve correct medial-lateral hoof balance, which may lead to coronary band shunting and undue strain on medial or lateral aspects of the navicular joint and the navicular suspensory ligaments.

3. Application of the old-fashioned ‘frog pressure theory’, which required lowering the heels to gain frog contact with the ground in order to maintain heel expansion. In practice, the quarters over-expand and separate, because of laminar shearing, and the heels contract.

4. The cause of narrow-webbed concave steel sections that fail to support the wall of the foot and encourage fine nailing, thus splitting and weakening the wall and causing the foot to collapse.

5. British hunter-style shoes - tapered heels and close-fitting are often fit too short, giving inadequate heel support and leading to collapse.

All the above factors will lead to increased or uneven stresses within the caudal part of the hoof.

Management and Environment Causes

1. Excessive moisture, through climatic conditions or poor management, causing saturated, weak feet that squash under a horse's weight,

2. The above may be complicated by sheared heels and general discomfort in the heel area. This may be aggravated by thrush, which could also even by the initial cause of the shearing.

3. Irregular shoeing routine, when left longer than the recommended four to six week program. When the toe is overlong, the heels of the shoe become buried in the foot causing collapse of the heels and lack of support to the caudal part of the foot.

4. Irregular exercise, such as sudden hard work alternated with period of inactivity with periods of inactivity, disrupting lower limb circulation. Also long periods of standing in stables which will cause passive venous congestion.

5. Obesity. The feet carry more weight that they were designed to carry, especially young animals being overfed to satisfy the show judges.

Conformation Causes

1. Long, sloping pasterns cause the line of weight distribution down the limb to fall posterior to the heels.

2. Medial-lateral imbalance of the foot causes strain to the medial or lateral aspects of the navicular joint. This will also cause sheared heels.

3. Disproportionate body weight to bone size and foot size, especially in crosses between Hanoverians and Thoroughbreds.

4. Shoulder lengths and angles that do not correspond with pastern angles, inhibiting proper flexion and extension of the limb and increasing the negative effects of concussion.

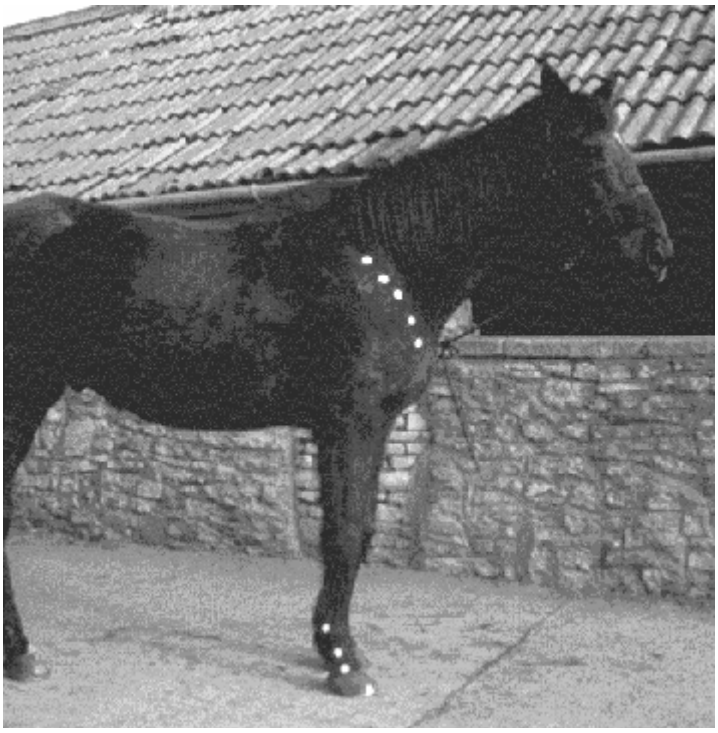

Figure 2 none matching shoulder and pastern angles inhibit proper flexion

Diagnostic Clinical Signs

There are a great number of signs or clues available in changes in a horse's behaviour, gait, feet and shoe wear, which if interpreted correctly and assessed as a whole, will aid in a positive diagnosis of a developing prenavicular syndrome before the lameness becomes apparent. With experience, a characteristic pattern can be seen to emerge.

Behaviour Changes

1. The horses may become sour and nappy is in constant discomfort.

2. May show reluctance to work on one diagonal.

3. May be reluctant to work in small circles.

4. May be reluctant to canter on one lead or the other.

5. May be reluctant to extend the stride.

6. May flatten over jumps or may refuse.

7. May be uncooperative while being shod.

8. May develop individual changes in manner not associated with front foot pain, e.g. head shaking.

It should be noted that many of the above symptoms are often interpreted as schooling problems and treated as such.

The psychology of each horse has a very important influence on the progress of the disease and its treatment. Working horses (eg., hunters and polo ponies) seem to adjust to discomfort. They may come out of the stable lame

but warm up into relative soundness, depending upon each individual's courage.

Pet horses, however, seem to play on lameness and even exploit it, given encouragement by the owner. They come out of the stable lame and are immediately taken out of work and rested.

This is a vital factor, as response to treatment is directly related to keeping the hose in regular daily work.

Gait Causes

It is important to appreciate that many horses that are not ‘lame’ are in fact uncomfortably in both front feet, and *some degree of bilateral forelimb lameness is present.* If this is suspected, it can be tested for by either nerve blocking one foot, in which case lameness may become apparent in the opposite foot, or by corrective shoeing of any one foot, which may have the same result.

There is also much to learn from watching the horse while it is standing or being shod.

Diagnosis Signs Evident in Motion

1. Disinclination to extend into the anterior phase of the stride.

2. Characteristic mild lameness that disappears as the horse warms up.

3. Unmistakable ‘punching’ of the toe into the ground as the foot lands.

4. Dragging of the toe of a front foot (squaring the toe of the shoe) of or all four feet.

5. Spidery action if the front limbs, which seem to follow no distinct flight pattern and give the appearance of throwing all the weight back onto the hindquarters.

6. Hind feet advanced further under the body to relieve the front feet.

7. A generally reluctant attitude to work.

8. Shortening of the normal length of the stride.

9. Adduction or abduction of one or both forelimbs in flight.

10. Brushing, or interfering resulting from the above.

Figure 3 abnormal shoe wear typically dragging of the toe indicating a lack of flexion is often evident in horses with caudal heel pain

Diagnostic Signs Evident at Rest

1. Constant shifting of weight from side to side (‘rocking’).

2. Pointing of one foot or both feet alternatively.

3. Reluctance to bear weight on one foot when the other is held up.

4. Reluctance and obvious discomfort when one forelimb is held in an extended position, as in clenching up, when the weight is borne on the heel area of the other foot.

5. Hind limbs advanced further under the body than normal and spread wider, toe enlarge the base of support.

6. Standing up off the heel area. The pastern becomes vertical, although the heels may not leave the ground, in an effort to relieve the caudal parts of the foot.

Figure 4 typical stance of many horses exhibiting caudal heel pain with both front and hind feet positioned under the body and the front limbs exhibiting a broken back \HPA

The Feet

The farrier is in the ideal position to observe changes in a horse's feet, far more so than the owner or veterinary surgeon, and especially if the horse is shod in a regular routine. Dramatic change can occur in the shape of a hoof in a six week interval; other changes can be long-term and insidious.

The front feet of navicular and prenavicular horses fall into three distinct categories;

a) Flat, squashed feet
b) Upright, boxy feet
c) One foot of each type

Diagnostic evidence of front foot paid is often so apparent in hind feet.

Type A Feet Characteristics

1. Hoof-pastern axis is broken-back, often to an extreme degree.

2. Hoof measures more from quarter to quarter than from toe to heel.

3. Heels are collapsed, folded under, and contracted.

4. Frog is bulbous and prominent, sometimes bruised.

5. Sole is flat, weak, and easily bruised.

6. Toe is long and at a low angle.

7. White line at the toe is stretched and may exhibit signs of haemorrhage.

8. There may be signs of bruising in the heel area and seat of corn. On a white foot, this may be visible on the out side of hoof wall.

9. The bulbs of the heels become squashed out behind the foot. The distance from the last bearing point of the heel to a line dropped behind the bulbs may measure up to two inches.

10. The heels may shear. Each half of the foot moves independently, because of a lack of support to the caudal parts of the foot.

11. Horn quality and rate of growth are poor.

12. The bars of the foot are non-existent, or are weak and distorted.

Figure 5 typical category A type feet exhibiting many of the clinical symptoms listed 1 – 12 above

Type B Feet Characteristics

1. The hoof to pastern axis is broken back, although this may only he evident in radiographs, as the hoof angle is more upright than in Type A feet.

2. The hoof contracts from the toe-quarter back.

3. The heels are spiky and contracted.

4. The frog is narrow and pinched and subject to thrush and atrophy.

5. The sole is concave, even vaulted.

6. Horn quality and growth appear to be normal, with most growth at the heels.

Type C Feet Characteristics

Horses that fall into this category develop this front foot disparity (one foot of each, Type A and Type B) over months or years. If discomfort if felt in one foot, the horse will favour it, throwing a greater portion of its weight into the opposite foot. In consequence, the supporting foot will squash under the added load while the favoured foot adjusts to pain in the heel area by going toe-first in motion, keeping weight off the heels and thus creating a more upright hoof with deeper heels and concave sole.

By compensating for pain in the affected foot by developing a accommodating foot shape and redistributing its weight load, the horse remains apparently sound. This situation may be termed *compensatory lameness.*

If the weight bearing foot is not adequately supported, the heels will collapse, blood circulation to the caudal parts of the foot will be impaired, and eventually, on radiographic examination, there may be evidence of a more advanced navicular condition than in the foot that was primarily lame.

Hind Feet Characteristics

If discomfort is felt in both front feet, the hind limbs will be advanced further than usual under the body, both at rest and in motion, to participate in weight-bearing and to relieve the front feet. Under this abnormal load, the hind feet can appear to be bursting out of the shoes, the nails break up the wall, and there may be difficulty experienced in nailing safely and keeping shoes tight. Under these conditions toe-dragging of the hind feet may be significant.

Figure 7 often neglected as part of an assessment of fore foot caudal hoof pain the hind feet will appear collapsed with little to no heel depth

If only one foot is affected as in Type C horses, a definite *diagonal factor* will be noticeable. The contralateral hind foot is invariably longer and broader than the other hind foot. A difference of up to one inch in shoe size is common.

This occurs because the *sound diagonal* carries the greater proportion of the body weight, while the hind limb of the *lame diagonal* deviates inwards and forward under the body and is effectively used as a prop, or crutch, to the

painful front foot. As a result, medial-lateral imbalance of both hind feet and abnormal shoe wear will be evident to some degree.

The diagonal factors accounts for many symptoms that are attributed to schooling problems, and serves to prove that the horse adapts to pre-navicular discomfort by altering its whole balance and movement.

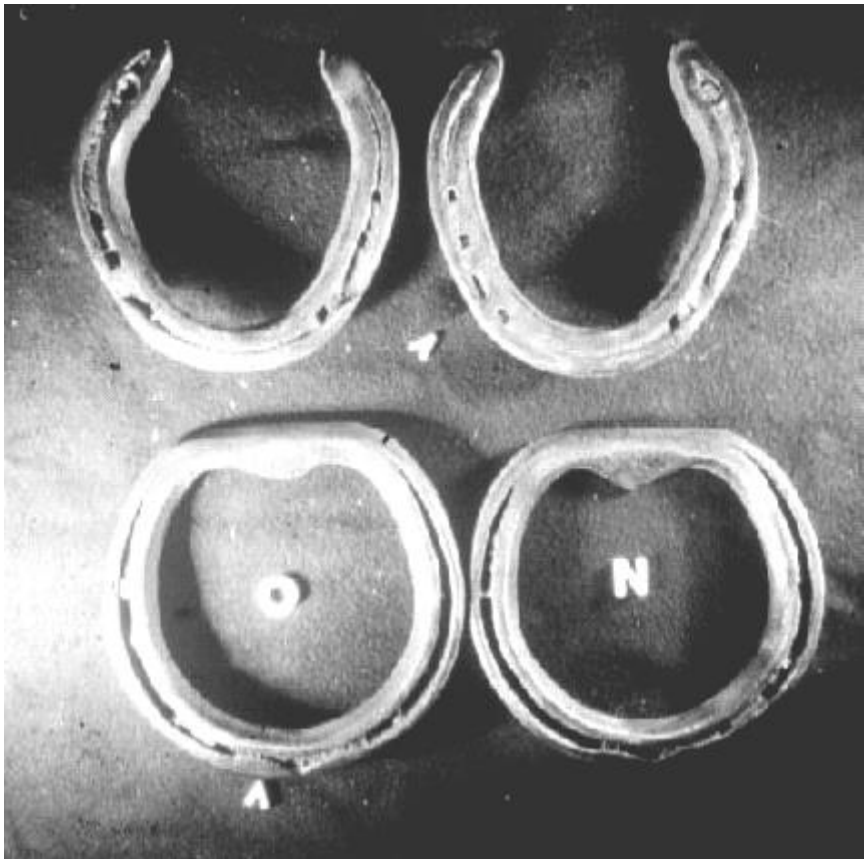

Figure 8 common front and hind shoe wear characteristics include abnormal toe wear and excessive wear of the medial branch of the hind shoe of the contra lateral limb.

Shoe Wear Characteristics

The interpretation of different patterns of wear on a set of shoes can reveal a great deal about developing conditions in individual feet or imbalance of the whole of the horse. The following are significant to the diagnosis of a prenavicular or navicular condition.

Front Shoe Wear Patterns

1. Heavy wear at the toe while the heels are as new, with the heads of the heel nails still prominent.

2. Toe-dragging squaring off the toe of the shoe caused by a shortened anterior phase of the stride. This is very characteristic of navicular pain (see Fig 5).

3. Grooves work into the quarters of heels of the foot surface of the shoe, caused by the overexpansion of a flat, collapsed foot.

Hind Shoe Wear Patterns

1. Heavier wear on the medial branch than the lateral branch, either of both hind feet or the hind foot of the weight bearing diagonal. (Fig 5).

2. Excessively heavy wear of the hind shoes, when accompanied by front shoes worn as in ‘Front Shoes Symptom 1’.

3. Toe-dragging - squaring the toe of the shoe - usually accompanies front shoe wear as in the ‘Front Shoes Symptoms 1 & 2’ and is significant in these cases, but should not be confused with concurrent hind limb lameness.

Treatment

Successful treatment of Navicular Syndrome is dependent on suitable mechanical correction of the foot.

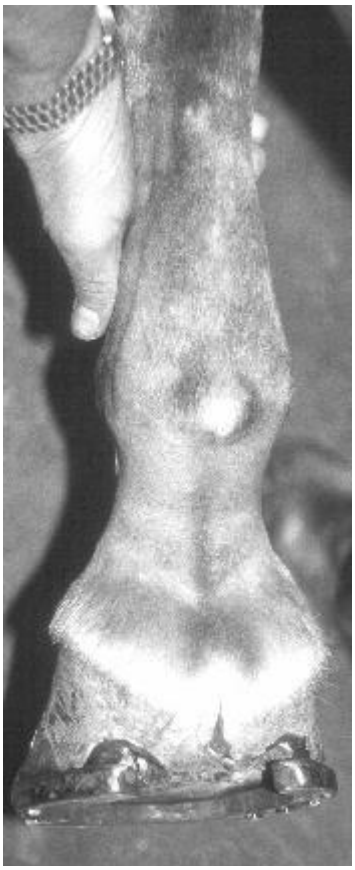

Figure 9 opposite illustrates the three main priorities in all cases must be:

1. The restoration of correct hoof-pastern axis;
2. The restoration of correct medial-lateral balance;
3. Full support of the caudal parts of the foot through shoeing.

Foot Dressings

Through practical experience, guidelines for dressing the feet have evolved. They should not be regarded as rigid rules, since each case should be treated as an individual.

The toe of the foot should be dressed back to create a hoof angle consistent with the horse's conformation, even to the extent of rasping away the toe and the stretched white line, in cases of very low angled collapsed feet.

Where the heels from an acute angle with the ground and are long, weak, and folding under, or are likely to collapse, they should be dressed down to provide a strong base of support when a correctly fit shoe is applied. Shoeing

over weak heels will only crush them further, delaying the objective of growing a new, solid heel at a more upright angle.

The angle through the centre of the pastern will be determined by the heel dressing, as the pastern will take on a loss upright conformation as the base of the support is lengthened.

The foot should be dressed to land level, and a balanced, symmetrical shape should be imposed upon it as far as possible, with flares and any separations at the quarters controlled.

The sole must not be thinned on feet that require severe correction. For practical purposes, the hoof must mot be over-lowered, to provide as much protection as possible and to keep the horse comfortable at work.

It must be appreciated that the hoof and its internal parts will restructure themselves to accommodate the new directions of stress and weight bearing once the point of break over has been brought back and correct conformation regained. The equine foot is more malleable than is generally supposed, and just as it will collapse and stretch under favourable conditions, so can it be reshaped and restored to normal functions.

Shoeing Treatment

Once the feet have been dressed to correct the balance and angulations of the lower limb and foot conformation, it is normally necessary to fit a flat, fullered concave shoe, with generous cover and with full length at the heels. Heel length in all cases should extend as far back as that point where the frog is at its widest, generally about 1/8 inch longer than the last bearing point of the wall, and boxed-back to avoid the shoe being trodden off.

Figure 10 a good example of the type of shoeing protocol used in the treatment of Pre-navicular Syndrome. A broad section fitted to extend to the widest point of the frog with width to accommodate heel expansion, the heels slightly elevated and fitted with a rolled toe

From the quarters back, the shoe is fit slightly wider than the wall, with the heels supported on the centre of the web of the shoe, to encourage natural function of the caudal parts of the foot and to insure that the shoe is not inside the foot after the interval between shoeings. Where contraction has occurred, the shoe is fit to where the hoof *should* be, to encourage the foot to regain its natural shape.

The heels of the shoe are upright - as opposed to the tapered ‘hunter heel’ - for maximum support.

The basic method of shoeing appears to be all that is required to regain full soundness in the majority of cases of Navicular syndrome. Even some horses that will display radiographic navicular lesions will go sound again when shod in this manner.

When the wall at the toe has been drastically reshaped to influence the hoof-pastern axis, some modification to the above should be made. The toe of the shoe should be drawn down - thinned - to facilitate break over, and the shoe should be fit unclipped, or with side clips, to avoid pressure on the lamina of the toe. Nail holes must be placed safely back in the quarters.

In extreme cases of collapsed feet (Type A), it may be necessary to use an egg bar shoe, fit directly under the bulbs of the heels. (fig. 9). Other bar shoes are useful in cases of sheared heels, to stabilise the caudal parts of the foot, and to restrict independent movement of the medial and lateral parts of the foot. In certain cases the contracted feet where the heels are strong and deep and turn in at right-angles to the wall at the quarters, compressing the frog (Type B feet), a bar shoe is the only way to cover the heels and give width to promote expansion.

A graduated-heel ‘navicular shoe’ can be a useful measure in specific cases, e.g., some Type B feet where the shoe can be used to mechanically restore the correct hoof-pastern angle, and also to relieve acute discomfort in the navicular area. The principle can be combined in a bar shoe by selecting a thicker section, fire-welding in the toe, and graduating the height from the quarters.

It is imperative in all cases to extend the length of the shoe back directly under the line of weight bearing down on the limb. Raised heel shoes (specifically for Type A feet) can compress and further weaken the heels of the foot.

Wedge pads temporarily alleviate the symptoms of pain in the heel area, and for such a purpose can occasionally be useful, but bury themselves in the heels and frog, and even over a short period of time can do great damage. Consequently, they have no real place in corrective shoeing of this type.

Results

Of group A, those with diagnosed navicular disease, only one of the ten horses (no 7) failed to show any initial improvement with drug therapy and corrective shoeing. The horse was destroyed.

Of the remainder, No 1 became sound but relapsed twice and was still lame at the end of the trial. No 10 showed initial improvement but no follow-up information was available.

Six horses were known to be still sound at the end of the trial and after all drug therapy had ended. Five out of six shoed significant improvement in foot balance following corrective shoeing and one course of drug therapy. The sixth horse (no 5) regained complete soundness after a second course of Isoxsuprine, but failed to show any improvement in foot shape or balance.

Of group B, those identified with symptoms of prenavicular syndrome, only no. 6 did not improve after corrective shoeing, and no follow-up information was available for no. 7. No. 2 improved dramatically following corrective shoeing but had to be destroyed because of Colic. At the end of the trial period, the remaining seven had shown improvement in performance and hoof balance.

It may be significant that the average age of the horses in group A was 10 years, 3 months, while the average age in group B was 9 years, 6 months; i.e., the horses with prenavicular syndrome were nine months younger than the horses with diagnosed navicular disease, on average.

It was noted, and considered important, that in four cases in group A, the lameness reappeared if the shoeing program was extended past a five or six week period, or if the horses were box rested for any length of time. Thrush was a problem with six out of the twenty horses studied, producing symptoms

of pain in the heel area similar to navicular symptoms and complicating cases where the heels were sheared.

Although the limited size of the trial would make firm conclusions premature, the preliminary results are encouraging and would seem to indicate that the restoration of correct foot and limb balance by shoeing has a positive effect on the long-term prognosis of both prenavicular syndrome and diagnosed navicular disease.

Discussion

There appear to be two distinct and separate theories about corrective farriery for the treatment of navicular disease. Ostblom (1982) claimed 58% success (permanent relief of signs) with the use of the egg bar shoe without drug therapy. Rose, meanwhile, (1983) recommended the raised-heel, rolled-toe shoe (also advocated by Emery, Miller and Vanhoosen, 1977). It is reasonable to assume that both Rose and Emery, working in Australia and the United States respectively, were treating a boxy, upright (Type B) foot - normal in a dry climate - while Ostblom, in Sweden, stated that he worked on low-heeled, long-toed, collapsed foot (type A), which are common in wet climates such as Northern Europe.

The type of foot may also account for the great discrepancy in the success rates claimed for Isoxsuprine by two researchers - Rose claiming 85% success with the drug, while Colles has stated that he only found a 28% success rate.

The results of this trial would seem to bear out the theory that the egg bar shoes achieves good results in cases of Type A feet, and flat or raised-heel shoes used in conjunction with Isoxsuprine have better results with Anglo-Arab, Arab and pony types which are not predisposed to the flat-footed type of conformation.

This would seem to indicate that the correct choice of shoeing technique is very important to the long-term prognosis.

Conclusion

The results of the trial indicated that effective diagnosis and treatment of navicular discomfort, pain, and impending overt lameness (the prenavicular syndrome) may be instituted long before radiographic evidence can confirm a diagnosis of navicular disease.

The onset of navicular disease is gradual and insidious. However, it is possible to arrest it and even reverse its effects as long as the root mechanical causes are corrected through shoeing.