SOME STUDIES ON EQUINE HOCK JOINT DISEASE WITH PARTICULAR REFERENCE TO TARSAL OSTEOARTHRITIS.

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SUMMARY

This dissertation is concerned with diseases of the equine hock, particularly tarsal osteoarthritis.

A detailed description is given of the anatomy of the tarsus, resulting from study of anatomy texts, and from detailed dissection studies in normal hock joints. The effect of variation of position of limb and X-ray beam on the radiographic appearance of the joint was investigated and recommendations are made concerning an efficient and consistent system for visualisation of the joint spaces. Satisfactory demonstration of the joint edges was also required for identification of pathological lesions at the joint edge, or just within the joint, and techniques for achieving this are discussed.

The literature concerned with tarsal osteoarthritis is reviewed, under basic headings of diagnosis, pathology and aetiology, and treatment. Relevant literature is discussed in relation to the results of work done. A follow-up survey of cases of suspected tarsal osteoarthritis seen at Glasgow University Veterinary School in the years 1972 - 1977, was conducted. Some of the cases were treated surgically and others by conservative means. The results of various forms of treatment are given from reports sent in answer to the survey. Some of the horses were available for re-examination and are included. Radiographs of various lesions encountered in clinical cases are included. The progression of lesions is illustrated.

Other hock lesions are described briefly from relevant literature. Reports are given of cases of hock lameness seen at Glasgow University Veterinary Hospital between October 1976 and July, 1977.

The aetiology, pathology, diagnosis, treatment and prognosis of tarsal osteoarthritis is discussed in relation to findings reported. The significance of hock lesions and their incidence is discussed.

GENERAL INTRODUCTION

Hock joint disease in the horse includes many different conditions, of differing aetiology. "Bone spavin" is the most common disease of the hock and this dissertation is concerned predominantly with this disease.

There is some difficulty in defining the term "bone spavin" in a precise and scientific way, as the word "spavin" has been used to refer to hock disorders for many years and is not specific in meaning. Another cause of ambiguity is the term "tarsus" which can be considered an alternative to "hock" in some instances. It is not clear from anatomical texts (Nomina Anatomica Veterinaria, Sisson & Grossman) whether "tarsus" or "tarsal" implies the tarsus itself and the tibio-tarsal joint, or simply the tarsus alone. Sisson described the tarsus as comprising the 6 or 7 tarsal bones in the horse and did not include the tibio-tarsal joint. Nomina Anatomica Veterinaria includes the tibio-tarsal joint under "articulationes tarsi", but under "tarsus" names only the tarsal bones, as does Sisson.

Thus, for the purpose of this study, the use of the word "tarsus" or "tarsal" implies the bones of the tarsus itself, their articulations, and the tarso-metatarsal articulation, but not the tibio-tarsal joint.

"Bone spavin" will be described as tarsal osteoarthritis, as this is a more accurate description of the condition, which is an intra-articular and peri-articular osteoarthritis of the intertarsal and tarso-metatarsal joints. Diseases involving the tibio-tarsal joint will be described as hock joint disease.

SECTION 1

ANATOMY

THE ANATOMY OF THE EQUINE HOCK JOINT

INTRODUCTION

The anatomy of the equine hock joint has been fully described in several texts (Share-Jones, Sisson & Grossman). These have been freely drawn upon, but in addition a number of joints have been examined in the completion of the following anatomical description.

MATERIALS and METHODS

Fourteen joints from ten horses were used in this study. All were considered to be normal.

The joints were skinned, then the fascial covering examined. The cunean tendon was identified, and the bursa opened by sectioning the tendon to check for any abnormality. The tibio-tarsal joint was opened and disarticulated and the joint surfaces fully examined. Ligaments of this joint were examined during disarticulation.

In nearly all cases it proved to be impossible to disarticulate the bones of the tarsus itself owing to the strength of the ligaments binding it internally. In one case the tibial tarsal was removed by the use of considerable force. In another case, even following section of the bones of the joint by sagittal saw cuts, the remaining parts still could not be separated. Thus, the cartilage surfaces of the tarsal bones were not seen, as the only available method of disarticulation was maceration.

The ligaments, blood vessels, and nerves were studied in detail on some of the specimens. Most of the joints were macerated after dissection, by boiling. Terms used to describe positions in this dissertation are:- medial and lateral; to refer to the side nearest to, or furthest from, midline; proximal and distal for nearer to, or further from, the trunk of the animal; and dorsal and plantar respectively for the aspect of the hind limb that faces the head of the horse, or the tail.

RESULTS

Osteology/

RESULTS

Osteology

The tarsus of the horse consists of 6 or 7 bones, with numerous complex articulations, (Figs. 2 & 3) but forming two main intertarsal joints which divide the tarsus into three distinct rows dorsally. In the proximal row are the talus medially, and calcaneus laterally, in the next row is the central tarsal, a flat bone, distal to this, in the third row is the flat third tarsal bone. On the plantar aspect of these two distal rows and extending across them, are the fourth tarsal, a somewhat cuboid or rectangular bone, lying laterally, and the irregularly shaped fused first and second tarsals medially. This latter bone may be present as two separate elements in a small percentage of cases (see later), as it forms from two separate centres of ossification, which do not always fuse.

The tarsus articulates proximally with the distal end of the tibia, via the talus, and distally with the heads of the third metatarsus, and second and fourth metatarsi (splint bones).

The Bones of the Tarsus

The talus (tibial tarsal) presents two trochlear ridges proximally for articulation with the tibia. These slant forward, downward and outward. In the groove between them there is usually a shallow synovial fossa, a normal defect in the cartilage and occasionally the underlying bone. There may be a corresponding defect in the ridge of the distal tibia. Distally the ridges of the talus project beyond the distal articular surface and the lateral ridge forms a hook-like projection. The distal articular surface is convex from before backwards, and mainly articulates with the central tarsal. There is a small oblique articular surface laterally on the distal surface for articulation with the fourth tarsal. The plantar surface presents several articular surfaces for calcaneus and is highly irregular. The medial side of the bone has two prominences, the proximal and distal tuberosities./

tuberosities.

The calcaneus (fibular tarsal bone) is the largest tarsal bone. It consists of a body (corpus calcanei) and a medial projection, (sustentaculum tali). Proximally, the body expands to form the tuber calcis to which the achilles tendon attaches. The distal extremity has articular facets for the fourth tarsal. Medially, there is a strong projection (sustentaculum tali) which has an oval concave articular surface dorsally for articulations with the talus. Its plantar surface has a groove for the deep flexor tendon to pass over. The dorsal border of the body is concave, and has articular facets for talus. At the centre of the body there is a bluntly pointed projection laterally, the processus cochlearis, which also articulates with the talus. The long plantar ligament attaches to the straight, roughened plantar surface of the body.

The central tarsal bone is flattened from above downwards and is irregular in outline (Fig.1). The proximal articular surface articulates with the talus, and is concave from before backward. The articular surface curves around the border of the bone, leaving a non-articular area extending from the lateral plantar border towards the centre. Ligaments attach to this and to similar areas of other tarsal bones, binding them closely together. The distal surface is slightly convex with a non-articular groove running medially to laterally and presents surfaces to articulate with third tarsal predominantly and also fourth tarsal in an upward curving surface to the lateral side of the plantar border. Dorsally and medially, a slight ridge extends around the bone, being more prominent medially. The plantar border has two prominences separated by a notch; the medial one bears articular facets for first and second tarsals, the lateral for the fourth tarsal. The exact shape of articular surfaces varies between horses, some having more articular area and others less.

The fourth tarsal bone is situated behind central and third tarsals, on the postero-lateral aspect of the tarsus. It is an irregularly cuboid bone, and has three main articular surfaces. Proximally,/

Proximally, it articulates with calcaneus, distally with the heads of the third and fourth metatarsals, by an angled articular facet, and medially, at its dorsal border, with central and third tarsals by a small angled facet. The external surface of the fourth tarsal forms the postero-lateral external outline of the distal part of the tarsus and is irregular with two small prominences, one on the dorsal part, one on the plantar.

The third tarsal bone is flattened from above downwards, similar to the central tarsal below which it lies. Its shape is basically that of a quarter section of a circle when viewed from above or below (Fig.1). Proximally, it has a broad band of articular surface running around the curved dorsal part of the face, and a smaller surface at the angular part. These areas are separated by a non-articular groove that is narrowed medially. On the distal aspect, the articular surface continues around the edge of the bone except for a small area laterally from where the non-articular central area expands. The angle of the plantar aspect of the bone is less prominent on this face. In proximal - distal thickness is almost exactly the same as the central tarsal, and has a more prominent ridge on the medial side than that of the central tarsal.

The third tarsal articulates distally with the head of the third metatarsal bone and on the distal latero-plantar aspect has a small facet for fourth tarsal. It also has a small articulation with the fourth tarsal at the proximal tip of the palmar prominence. On the medio-plantar aspect it articulates with the second tarsal.

In the horse, first and second tarsals are usually fused, fusion in most cases occurring prior to birth (Sisson & Grossman 1975). Brown and MacCallum (1975) examined a number of foals of between 52 - 104 days of age and gave the following statistics concerning fusion of first and second tarsals.

A.	Bilateral fusion	43.5%
B.	Bilateral separation*	17.4%
C.	Unilateral fusion (separation in opposite limb *)	13%
D.	Bilateral recent fusion **	8.7%
E.	Unilateral recent fusion (fusion other leg **)	13% /

E. Unilateral recent fusion (fusion opposite limb**)

F. Unilateral recent fusion ** (separation in opposite limb *) 4.4%

* Articular space present.

** Separated after maceration at line of fusion.

This would seem to imply that at least the animals in groups A, D and C would eventually have bilaterally fused first and second tarsals, this being 65% of the total. Some of the animals in groups C and F may also fuse bilaterally and would certainly be unilaterally fused, these groups being 17.4% of the total.

MacCallum and Goyal (1977), found that in older horses, aged 9-17 months, 38 of 49 hocks examined (77.5%) had fused first and second tarsal bones, and 3 were partially fused. Data relating to hocks examined at Glasgow University Veterinary Hospital is set out below:-

	normal hock joints	hock joints with tarsal osteoarthritis
number macerated	14	6 (from 4 horses)
number with fused first & second tarsals	14	3
number with unfused first & second tarsals	0	3 *

* One hock was from a pony with total non-exostotic ankylosis of the central and third tarsal bones (Figs. 17, 18). It had been radiographed prior to death and the other hock was apparently normal with fused first and second tarsals.

In addition, radiographs of three horses revealed non-fusion of first and second tarsals. Of these, two had tarsal osteoarthritis lesions, and the third was a three year old with very tied-in sickle hocks who showed hind leg lameness at times although no lesion could be found.

The degree of fusion and therefore the exact shape of the bone varies considerably between horses, some being fused in only a small area, others over a larger area. The first tarsal is an approximately triangular bone, the apex articulating with the second tarsal on the medio-plantar aspect of the hock. The outer surface/

Fig 1

This shows normal tarsal bones from a sound 11 year old pony. The surfaces and bones shown are:-

Proximal surface, central tarsal, right hock.	Distal surface, central tarsal, left hock.
Proximal surface, third tarsal, right hock.	Distal surface, third tarsal, left hock.
Proximal surface, first and second tarsals, left hock.	Distal surface, first and second tarsals, left hock.

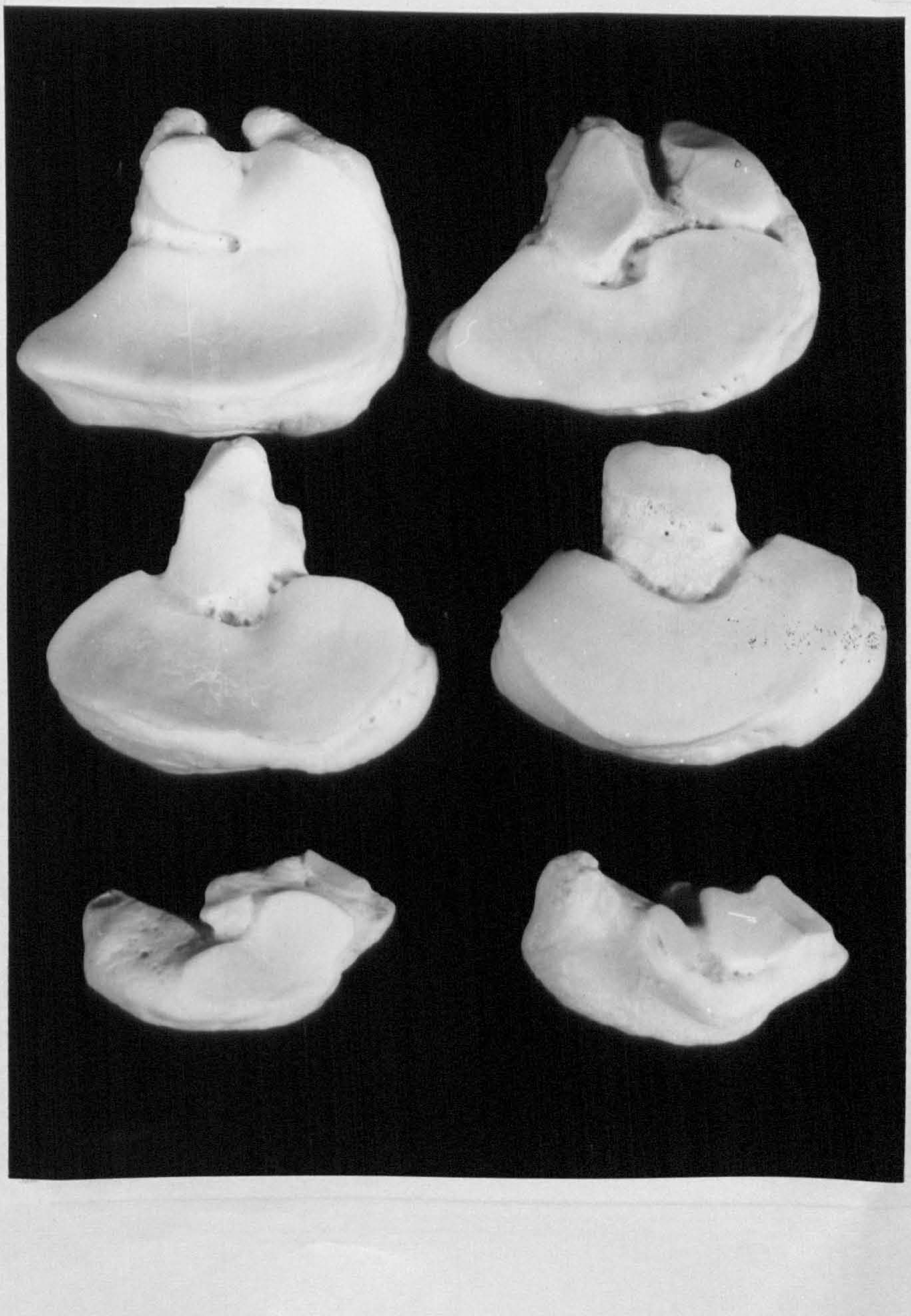


Fig 2.

This is a dorso-lateral oblique view of the left tarsus of a sound 18 month old pony. The tarsus is normal. The craniolateral-caudomedial oblique radiograph is taken from approximately the same angle as this photograph. Note the hole(h) between fourth tarsal posteriorly, and central and third tarsals anteriorly.

C	calcaneus	T	talus
a	central tarsal	3	third tarsal
4	fourth tarsal	M	metatarsal 3
m4	metatarsal 4		

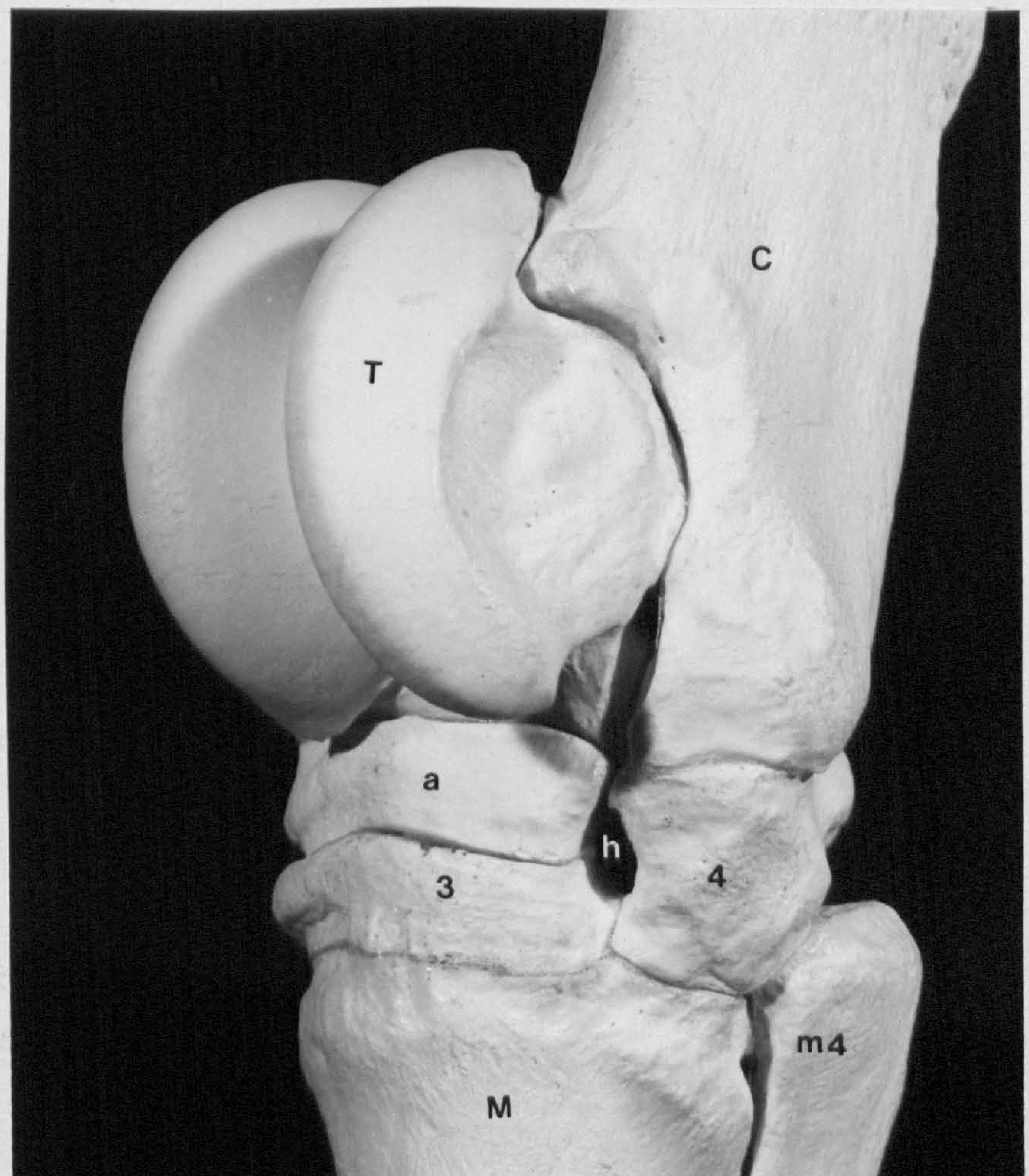

C
T
a
h
3
4
m4
M

Fig 3.

This is the same tarsus as illustrated in fig. 2, but the view is a plantar-medial oblique. Thus the tarsus has been rotated through 180 degrees from the previous figure.

C	calcaneus	T	talus
a	central tarsal	3	third tarsal
4	fourth tarsal	M	metatarsal 3
m4	metatarsal 4	m2	metatarsal 2
1	first tarsal	2	second tarsal

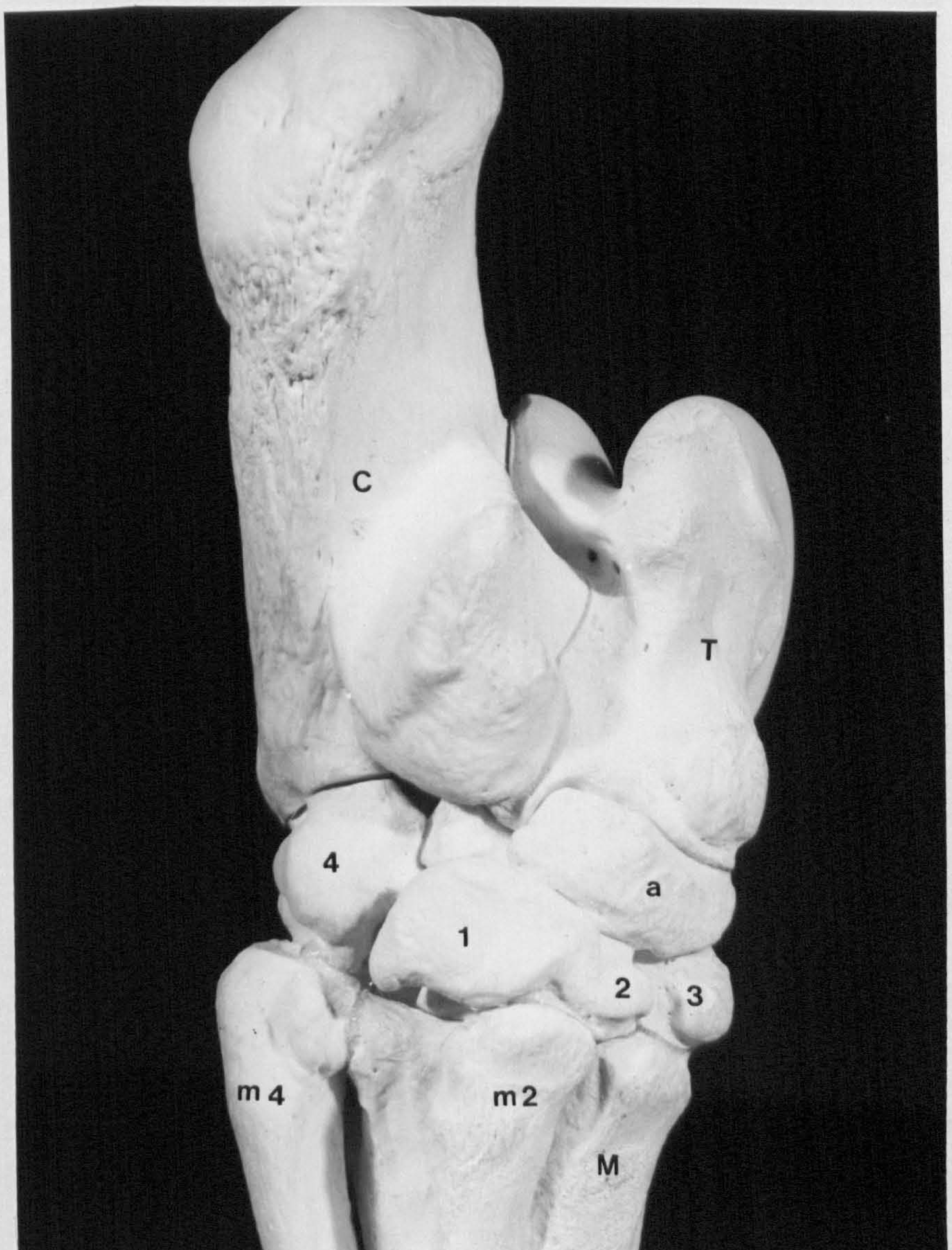

C
T
4
a
1
2
3
m4
m2
M

Fig. 4.

This is a view of the dorsal aspect of a left hock, partly dissected. The cunean tendon (C) is visible emerging from the tarsal fascia and running medially across the tarsus, to insert to first tarsal.


C

surface of this bone forms part of the outline of this aspect of the hock. The bone is slightly curved from base to apex, presenting a convex face externally, and a concave one to the central and third tarsals dorsally. Proximally, it articulates with the central tarsal by a facet near the apex of the bone, and distally with the head of the second metatarsus. The base may be very close on the plantar aspect to the apex of the third tarsal and these bones may have roughened corresponding areas.

Dorsally, the first tarsal articulates with, or is fused to, the second tarsal. This is a very irregularly shaped bone and is the smallest in the tarsus (Fig.1). Fusion of these two bones is commonly found and varies in degree. In some cases they appear as one bone, in others, there is a relatively small area of fusion, revealing their origins in two separate centres of ossification. A minority of hocks show total non-fusion, in which case an articular space and normal joint surfaces are present. The second tarsal articulates with the central tarsal proximally, and distally with the head of the third metatarsus by a small facet, and that of the second by a larger one. On the medial aspect of the hock it articulates with the third tarsal.

The head of the metatarsus, with which the tarsus articulates distally, (via the distal face of the third tarsal) presents a fairly flat crescentic articular surface dorsally and a small, rectangular one on the plantar side. There is a ridge running across the crescentic surface near its lateral end, lateral to which the fourth tarsal articulates. The proximal articulation of the tarsus is via the trochlea of the talus to the distal tibia, the articular surface of which consists of two grooves separated by an oblique ridge. The joint is stabilised laterally by the medial and lateral malleoli of the tibia to which ligaments attach.

Joint Capsule and Synovial Structures of the Joint

There are many articulations in the hock and the tibio-tarsal articulation is responsible for the great majority of flexion and extension of the joint; it is a ginglymus joint. The intertarsal and tarso-metatarsal articulations allow very little movement as they/

they are so closely bound by ligaments.

The joint capsule attaches proximally to the tibia, around the margin of the articular surface and distally to the metatarsi. It also attaches to the tarsal bones which it covers and blends intimately with their collateral ligaments. Dorsally the capsule in the tibio tarsal joint is thin and will show distension due to increased synovia. On the plantar aspect it becomes thick and attaches closely to the tarsal bones forming a smooth bed for the deep flexor tendon. The capsule continues distally to form the subtarsal check ligament, uniting with the deep flexor tendon about the middle of the metatarsal area.

There are four synovial sacs; tibio tarsal, proximal intertarsal, distal intertarsal and tarso-metatarsal. The first two communicate dorsally.

Ligaments

The medial ligament has two main parts, the long part extending from the medial malleolus of the tibia to the second and third metatarsi and medial aspect of the tarsal bones. The short part is mainly covered by the long and extends from medial malleolus obliquely distally and towards the plantar aspect, then divides into two branches, one to the talus and one to sustentaculum tali of calcaneus.

The lateral ligament is also bipartite, the long part extending from lateral malleolus distally to calcaneus, fourth tarsal, and third and fourth metatarsi. The short part arises anterior to the long on the lateral malleolus and extends to the lateral surface of talus and calcaneus. Supporting the plantar face of the tarsus is the plantar ligament, a strong flat ligament attaching to calcaneus, fourth tarsal, and fourth metatarsal.

The dorsal ligament is a strong fan-shaped structure extending from the distal tuberosity of the medial face of the talus, and widening to insert over the majority of the dorsal aspect of the central and third tarsals and the second and third metatarsals. These are the main external ligaments of the tarsus, however, there are/

are also ill-defined interosseous ligaments, uniting the non-articular areas of the flat articulation very firmly. These articulations are almost impossible to open without maceration. Several attempts were made to do this but in only one case was it possible to remove bones, these being the talus and calcaneus. The other bones are too thin and flat to enable sufficient force to be exerted to remove them.

Muscles, tendons and fasciae

Dorsal group

The long digital extensor is the main extensor of the digit, and a flexor of the hock. The tendon is long and begins above the tarsus, passing through proximal, middle and distal annular ligaments of the tarsus, then down the dorsal aspect of the metatarsus. The lateral digital extensor becomes tendinous just proximal to the tarsus and passes on the lateral aspect of the joint through three annular ligaments in a channel inthe tarsal fascia, to the metatarsus. It joins the long extensor one-third to one-half of the distance down the metatarsus in most cases, but does not fuse in some horses.

Both tendons have a synovial sheath extending from the area of their origin to just below the tarsus. The tarsal fascia surrounds the majority of tendons in the joint area, and is fairly thick, forming annular ligaments and blending with ligaments of the area. The blood supply of these muscles is the anterior tibial artery and the innervation the fibular (peroneal) nerve.

The fibularis (peroneus) tertius in the horse is a strong tendinous band which acts mechanically to co-ordinate hock and stifle movement, flexing both if one is flexed. Two branches insert on the tarsus, the dorsal one to third tarsal and metatarsal, the lateral to calcaneus and fourth tarsal. Tibialis anterior is a large muscle lying anteriorly on the tibia, deep to fibularis tertius and is a flexor of the hock. It has two insertions. Dorsally, it inserts to the ridge on the dorsal aspect of the third metatarsal, medially, to the first tarsal bone. The medial part is known as the cunean tendon (Fig.4) and crosses the dorso-medial face/

face of the hock obliquely. A bursa (the cunean bursa) is interposed between it and the medial ligaments of the tarsus.

Plantar Group

Gastrocnemius, which has two heads, attaches to the tuber calcis by the calcanean tendon, and is the main extensor of the hock. A small bursa lies dorsal to the insertion and a larger one lies between the two tendons of the muscle. The superficial digital flexor is mainly a strong tendon, which inserts to the tuber calcis in part, and in part runs down to the first and second phalanges. It is an extensor of the hock and flexor of the digit. At the point of the hock, the tendon is flattened, forming a cap-like covering, then it runs down over the plantar ligament and is perforated by the deep flexor tendon in the metatarsal area.

The deep digital flexor is a three bellied muscle. The largest tendon of this muscle runs medial to the body of calcaneus, over the sustentaculum tali in a groove lined by tarsal fascia and bound down by the plantar annular ligament, which is formed from the tibialis posterior and flexor hallucis tendons. The medial tendon descends in a canal in the medial ligament of the hock, and joins the common tendon about a third of the way down the metatarsus. These muscles are supplied by the posterior tibial artery and tibial nerve.

Blood Supply

The femoral artery is the principal supply of the hind limb. The popliteal artery is a direct continuation of this and splits into anterior and posterior tibial arteries. The posterior tibial divides into medial and lateral tarsal branches, after supplying the posterior tibial muscles. The medial branch descends with the deep flexor tendon and divides to form two plantar arteries. These anastomose with branches of the perforating tarsal artery to form four plantar metatarsal arteries, two superficial, two deep. The lateral tarsal artery is distributed to the lateral surface of the hock.

The/

The anterior tibial artery is the larger of these two branches of the popliteal artery. It gives branches to the dorso-lateral muscle group of the leg and to the hock. The perforating tarsal artery arises at the proximal part of the hock and passes into the vascular canal of the hock, which is in the tarsal fascia in the dorsal part of the hock. It unites at the proximal metatarsus with the plantar arteries. It is continued as the great metatarsal artery which splits to form the digital arteries. The veins are mainly satellite to the arteries.

<u>Innervation</u>

The nerve supply to the tarsus is predominantly from the tibial and deep peroneal nerves, which are both part of the sciatic nerve. The tibial nerve is a direct continuation and the deep peroneal a branch of the sciatic. The tibial nerve gives off the medial and lateral plantar nerves, as it runs in the tarsal canal of the deep flexor tendon. The medial branch descends on the medial border of the flexor tendon towards the hock. The lateral branch deviates to the lateral border of the flexor tendons, and as it does this gives off a deep branch to the suspensory ligament and deeply into the tarso-metatarsal joint area.

The deep peroneal nerve runs in the vascular canal of the tarsus and divides on the dorsal aspect of the tarsus. The medial branch gives off a branch which divides extensively and passes through the ligaments in the dorso-medial aspect of the tarsus. This would appear to be the main supply to the "site of spavin". It also supplies fibres running deeply proximally into the ligaments. The lateral branch descends with the great metatarsal artery, after giving a twig to the extensor brevis muscle.

Some authors (Sisson, Share-Jones) describe the tibial nerve as supplying fibres to the "site of spavin". (i.e. medial aspect of central and third tarsals, first and second tarsals and second and third metatarsal heads).

Three/

Three detailed dissections were performed in an attempt to elucidate the innervation of the "spavin area". The only branches found from the tibial nerve were hair-like, at a distance of six centimetres or more from the area in question. However, extensive branching running into the area from the medial branch of the deep peroneal nerve was found.

SECTION 2

TARSAL

OSTEOARTHRITIS

"SPAVIN"

Introduction

The term spavin has been derived from words used for many centuries to refer to pathological processes occurring in the hock joint. The first known reference to this usage of the word was by Jordanus Ruffus in the thirteenth century; he used the mediaeval dog-latin word spavenius (Goldberg 1913). This was also used in various other similar forms (sparvenius, esparvanus, sparus and others) and originally meant bird or sparrowhawk. Similar words in other languages at the time also had this meaning, e.g. old high german Sparve.

This word was probably used to refer to a hock lameness due to the bird-like gait of an affected horse. Thus, from its origins, it is rather non-specific in meaning, and has been used to refer to many different maladies of the hock. Those were differentiated by adding a prefix such as blood, muddy, bog or moist, occult, dry or bone. Of these, blood referred to a distension of the saphenous vein on the medial aspect of the hock, muddy bog and moist to tarsal hydrarthrosis, occult to a purely intertarsal arthritic change and dry or bone to a periarticular exostotic arthritis of the intertarsal joints. In this dissertation the term spavin is used solely in its more modern connotation to include those afflictions of the hock which involve osteoarthritic changes in or around the intertarsal or tarso-metatarsal joints, i.e. bone spavin or occult spavin

Bone spavin is generally taken now to mean a periarticular arthritis causing a swelling on the medial aspect of the small tarsal bones, with or without actual articular involvement. "Occult spavin" is taken to be a purely intra-articular arthritic change, without periarticular exostosis. The term tarsal osteoarthritis is preferred, as it is considered more explicit.

The incidence of bone spavin has been referred to by several authors. Vaughan (1965) found that of 835 cases of hind limb lameness, 18.2% were/

18.2% were in the hock, this being the second most affected area, the foot being involved in 18.8%. 22.4% of these hock lameness cases (4.1% of the total), were due to bone spavin. Lundvall (1961) stated that bone spavins were the most common cause of hock lameness. Manning (1964) claimed that from a survey of the records of the University of Illinois, bone spavin is the most frequent cause of lameness in thoroughbred and standardbred horses.

REVIEW OF THE LITERATURE

I. Clinical Features

The clinical features of lameness due to spavin have been described by a number of authors. In 1751, Gibson in "A new treatise on the diseases of horses" noted that, in a case with an outward superficial spavin, the horse is only stiff initially, but in a higher spavin, deeply situated in the "sinuosities" of the joint, a horse is often lame for a considerable time before a spavin shows itself.

In 1829, Dietrichs (cited by Goldberg 1913) said that the swelling (of spavin) is in many cases unimportant; it is hardly visible during the early stages and yet the animal shows marked lameness. Youatt observed, in 1831, that the lameness of spavin abates, and sometimes disappears on exercise. Smith (1893) pointed out that not all spavins will produce lameness and size of the exostosis is not related to degree of lameness. He also said that it was probable that a spavined young horse would go lame with work, whereas an old one may not. He stated that the classical symptoms of bone spavin are the enlargement and heat of the area, a marked lameness which largely wears off with work, and returns with rest, resting of the hock and wearing of the toe of the shoe.

In his "Surgical Anatomy of the Horse", Share-Jones (1905) said that, initially, in many cases, lameness is not very apparent, only a diminished hock flexion being noted. Later, there is a pronounced lameness, particularly on first bringing the horse out, which disappears with exercise. He cited Macqueen who reported "It is a supporting leg lameness, and in consequence the quarter is carried low, and at the trot the quarter sinks a little". The toe of the shoe is said to become worn and the foot to gradually develop a boxy shape. Dykstra (1913) largely corroborated what others had said before him and stated that spavin lameness as a rule develops slowly, possibly out of phase with the development of a spavin exostosis. One of the first signs frequently observed is the sudden jerking of the affected limb, resembling string halt, and the limb is poorly extended, with shortening of the last phase of the stride; the fetlock/

fetlock becomes upright and the toe short. The lameness usually disappears with exercise, but may be constant, or even increase in long standing cases.

O'Connor, in Dollar's Veterinary Surgery (1950) described the features of spavin lameness. He commented that there may be a spavin with no lameness, or a lameness with no external exostosis (Occult spavin). He went on to say that some features are usually associated with spavin lameness:- viz., Imperfect hock flexion and toe dragging, putting weight on the toe when going, decrease of lameness on exercise, (except in severe or occult cases) lowering of the hip in progression at the trot and spasmodic flexion of the hock at rest. In addition, he said that the horse has a short, stiff gait if bilaterally affected and that gluteal atrophy may occur. Manning (1964) observed that the flexion and extension of the hock causes pain, so that efforts are made to restrict these movements, with results in shortening of the stride and placing the weight on the toe. In a bilaterally affected animal, the signs are less obvious and may be merely poor performance.

Adams (1974) stated that there is a reduction in the arc of foot flight and a shortening of the anterior phase of the stride. The foot lands on the toe, which becomes short, and the heel high, the dorsal edge also becoming worn due to dragging; the lameness tends to be worse when the horse is first used, particularly in mild cases, whereas in a severe case, the lameness may be aggravated by exercise. He also commented that the leg is advanced with imperfect flexion. Enlargement of the hock may be difficult to determine. Signs of occult spavin are stated to be similar to those of typical bone spavin lameness except for the lack of a visible exostosis.

II. Diagnosis

Diagnosis of tarsal osteoarthritis has been made by various means over the years, including history, clinical signs (appearance, palpation, the flexion test) and latterly, radiography and nerve-blocking techniques.

As early/

As early as 1551, T. Wilson in Logike, said, "We can se a spauain, a splent, a ring bone, or such other disease in a horse". Blundevil in 1580, described a spavin as a hard, walnut sized knob growing under the joint on the inside of the hock. In 1639, Thomas de Grey commented that "The signe to know it, is evident enough, viz by your eye and hand, for it is both visible and palpable enough, and as easie to bee scene and felt as the legge itselfe". All these writers referred to the obvious sign of a bony enlargement on the lower medial aspect of the hock which is often present. This was presumably the definitive sign for diagnosis at the time.

Smith, in 1893, described the importance of careful visual examination of the hock and of angulation of the joint in causing confusing variation in appearance of the various prominences. He also mentioned the value of palpation, but stated that a swelling which may constitute a spavin in one horse may be normal in another, and in diagnosis of spavin, comparison with the other hock is vital. He laid down parameters for diagnosis as:- position and size of enlargement, character of lameness, and duration of lameness. Share-Jones (1905) observed that on turning the horse sharply towards the sound side, the extra weight borne on the medial aspect of the affected leg caused an exacerbation of the lameness. He also referred to the "spavin test", consisting of forcible flexion of the affected hock for about a minute, then trotting the horse off. A positive result is taken to be when the lameness is more evident for the first few strides. However, he commented that too much weight must not be placed on the result of this test as many horses will be stiff afterwards. In addition to this, he mentioned careful palpation of the seat of spavin to locate normal grooves (or their absence) and comparison of the hocks; but in addition to the remarks of Smith, said that some horses have unmatched hocks and are normal and quoted examples of this.

Dollar (1950) wrote of various methods of visual examination of the hocks to check for spavin, involving comparison of hocks, palpation, and recognition of normal variability of conformation. He also said that/

that x-rays may be used, or cocaine injection over the tibial nerves if there was uncertainty as to whether lameness was in the hock or above.

Schebitz (1965) and Schebitz and Wilkens (1967) stated that wear of the toe of the shoe, knuckling of the joint, and pain after hock extension are suggestive of bone spavin. They commented that joint flexion is a simple way of localising pain, and suggested flexion of the hip, stifle and hock joints, followed by slow release. When tarsal lesions exist, slow extension of the joint reveals pain in the last phase of this. They also noted the use of local anaesthetic and suggested subcutaneous infiltration of the dorsomedial and medial distal tarsal area. By an effect on the lameness, this will demonstrate if the pain was due to tendon or periosteal lesions. If the lameness is due to lesions in the joint itself, only a partial recovery will result. Injection into the tibio-tarsal joint may then determine this, as anaesthetic will diffuse from here, into the vascular canal of the tarsus and hence block the dorsal ramus of the deep peroneal nerve, which innervates the small tarsal joints.

The same authors also state that radiological examination is essential, and aids exact diagnosis and choice of therapy. Two views are recommended:-

1. Oblique, from craniolateral to caudomedial, at an angle of 70° to the midline.
2. Oblique from caudolateral to craniomedial at an angle of 115° to midline.

They also stated that latero-medial and dorso-plantar radiographs are valueless in diagnosis of bone spavin.

Hamberg (1955) radiographed the hocks (post-mortem) of 103 horses. He took two views, at right angles, of these joints and claimed that only 59 of 199 joints showed change radiographically, whereas there was some change in the joints of all but one horse on examination post-mortem after maceration. All the horses were sound pre-mortem. Thus, he judged radiographic examination to be of little/

little value. To support this statement, he said that, of 15 horses claimed to have spavin, which had previously had hock surgery, definite radiological change was found in only 3 horses.

Manning (1964) stated that there is a tendency for the toe in an affected horse to drive into the ground and the animal is more lame after rest, or cramping of the hock by force flexion for two minutes. Radiographic examination should, he considered, be used, although the degenerative changes of osteoarthritis are rarely evident radiographically. However, peripheral lipping of the central tarsal may be frequently seen and rarefaction medially between the central and third tarsals. He commented that diagnosis should only be made on clinical examination, aided by radiography.

In his book, "Radiology in Veterinary Orthopaedics", Morgan (1972) stated that there may be cysts in the subchondral bone which open to the joint surface, resulting in an irregular widening due to atrophy of subchondral bone and sharp periarticular spurs may form. Adams (1974) mentioned that most cases of bone spavin react positively to the spavin test (as described before). He considered this test generally accurate, but said that confusion could arise in old arthritic horses and in animals with gonitis. Other diagnostic tests he mentioned were blocking of posterior tibial and deep peroneal nerves with local anaesthetic. (A complication of this was that other structures were also blocked), and infusion of the lower tarsal joints with local anaesthetic.

In 1973 O'Brien reported that degenerative joint disease of the distal intertarsal and tarso-metatarsal joints was the most common disease of the tarsus. He stated that evaluation of radiographs requires that anteroposterior and oblique views be examined for evidence of periarticular new bone, narrowing of the joint space, irregularity of subchondral bone, sclerosis or ankylosis. Good quality radiographs are essential so that joint space width can be evaluated. The two anteroposterior views taken are with the beam centred on the tibial tarsal and central tarsal bones, which allows accurate/

accurate evaluation of joint spaces and other radiographs suggested are obliques (as Schebitz) and latero-medial. Obliquity may result in a false impression of narrowing. He considered that the proximal intertarsal joint is usually slightly wider than the two lower joints.

Adams (1974) stated that four views of the tarsus should be taken:- lateral, cranio-caudal and two obliques. He considered that minimal changes could be overlooked if positioning was poor.

III. Pathology and Aetiology

The pathology of bone spavin has been the subject of a considerable amount of speculation, from the sixteenth century (and possibly before) until the present day. Theories on this subject, and on the cause, vary considerably.

In 1639, Thomas de Grey said that there were two causes of bone spaven, as he called it, one being hard riding "or other kinde of intemperate labour", the other by inheritance. His postulated pathogenesis of the disease was "The bloud dissolving, falleth downe and maketh its residence in the hough, which doth in short time become dry and hard as any bone, from whence the sorance taketh its denominator". Gibson (1751) suggested that spavins could be caused by overworking a young animal, by a hereditary predisposition, or by blows, or any other thing causing "humidity" upon the part. Among these factors were leaving at grass too long, feeding with too much heating food, lack of exercise, or excessively violent exercise. The disease occurred, he postulated, when the cement, by which the bones were united, overflowed, and formed a swelling in the hock, which in time becomes like the callus of a fractured bone.

Mayhew (1888) attributed the horse's problems with arthritis to being worked whilst immature and said that spavin was the change of ligaments into bone. A little later, in 1893, Smith said that spavins fell into two distinct categories, those ending in ankylosis and exostosis, and those ending in ulceration of the articular cartilage, with little exostosis and no attempt at ankylosis./

ankylosis. He further subdivided these two types according to site of the lesion. He considered that processes leading to non-articular (the first category) and articular (the second) spavins were not the same and that the two did not overlap, or develop into the other type at all. The condition that he called articular spavin produced "destructive caries" of the joint.

The progress of the disease was said to be initially, as an inflammation or congestion of the cuneiform bones, followed by the growth of small bony deposits from the surface of the bone, and also absorption or wearing away of articular cartilage. The bones become united in the denuded areas, and fixed together by bony growth, which possibly originated in the interosseous ligaments. Some joints were said to demonstrate cavities of varying sizes. True articular disease, he suggested, began as absorption of articular cartilage and grooving and eburnation of compact bone. Small holes then form, and gradually run together to form a granulation filled cavity. In this type of disease, ulcerations on opposing surfaces correspond. He postulated that the conformation of the hock may be a factor in the disease and suggested that an overhanging distal extremity of the inner ridge of the tibial tarsal bone, which is close to the articulation with the central tarsal, may be a predisposing factor. Also a "weak" (i.e. thin and curved) cuneiform bone was considered to be a predisposing factor. The most commonly found lesion was said to be ankylosis of central and third tarsal, the other tarsals were involved less frequently, and the head of the metatarsus even less so.

Harger (1901) made an anatomical and pathological study of ringbone and spavin. He mentioned that there was a controversy as to whether spavin progressed from a periostits inwards, or from an osteoarthritis of the hock bones outwards. He described the alterations found in four classes:-

1. Those without exostosis, with ankylosis of central and third tarsals, he described as occult spavin.
2. Those with ankylosis of central, third and first and second tarsals.

3./

3. Those with ankylosis of central, third, first and second tarsals and the metatarsus.
4. Those with ankylosis of central, third, first and second, and fourth tarsals.

There were also various specimens with other co-ossifications.

He said that in all cases (except for one doubtful case), lesions existed on the articular surfaces if there was a peripheral deposit of bone. He suggested that spavin lesions began as a central and third tarsal arthritis, rather than, as was often suggested, in the first and second tarsals. Occult spavin he postulated to be a case in which the lesions remain intra-articular for some time, and an external enlargement does not develop. Thus, he considered that spavin usually began inside the joint, at the articular surfaces, but may arise as a periostotis in occasional cases of trauma or ligament hyperextension. He suggested that if there was a defect in the organisation of the bone, the hock bones were subjected constantly to stresses caused by normal movement, and were thus predisposed to disease.

Moller and Dollar, in 1903, stated that Eberlein and Gotti considered the disease to begin in the bone as on "ostitis rarefaciens et condensans" and progress to the cartilage, periosteum and ligaments of the joint. Share-Jones (1904) described a theory that had been advanced to explain why spavin usually appeared on the lower medial aspect of the hock. This fact was attributed to the angle of the tibia causing a slight rotation at the tibio-tarsal joint and placing an increased pressure on the inner side of the joint. He also commented that cow-and sickle-hocked horses were thought to be susceptible to spavin. "Tied-in" hocks were also said to be affected more frequently than normal hocks, this being a hock with abnormally small central and third tarsals and head of metatarsus. Share-Jones quoted Williams, who believed in the theory of an ossific diathesis, whereby a horse was predisposed to producing osseous effusions, particularly growing or overgrown young horses/

horses being prone to this, when first put into work. Violent exercise, particularly in young animals, was said to damage ligaments at their attachment, also concussion jarred and damaged the articular surfaces.

Peters, quoted by Moller (1903) thought that soft and rough ground was particularly harmful, as the normal motion of the hoof on the ground was inhibited and hence this took place in the joints, especially the hock. Peters is again quoted by Dykstra in 1913, who states his theory more fully, and mentions that he said the ligaments of the hock joint inhibited all lateral movement except on the lower medial aspect where it is least protected by these ligaments. Dykstra also quotes Dieckerhoff who considered cunean tendon bursitis to have influence in starting the disease. Predisposition to spavin in horses with tied-in hocks was mentioned, also the ossific diathesis theory. He described the pathology as initially a rarefying osteitis, with formation of small cavities in the bone, filled with a granulation tissue type material. A condensing osteitis may follow this. Inflammation then extends to perioteum and/or articular cartilage, causing degeneration and active exudation with production of cartilage cells, resulting in an internal ankylosis. The periosteum responds by setting up an ossifying periostitis, causing an exostosis and external ankylosis.

He stated that both external and internal ankylosis were usually complete in younger animals, resulting in a return to soundness. However, in older animals, the internal ankylosis tended to remain incomplete and lameness remained.

During the late 18th and 19th centuries, there were a considerable number of references to, and descriptions of the pathology of spavin. These were reviewed by Goldberg in 1913, from whom the following references are taken.

The hardening of lymph or other liquids, either in the ligaments of the hock joint, or after leakage from vessels, was a very popular theory in the late 18th century. It was mentioned by Von Sind (1770)/

(1770) as a sequel to muscular exertion causing irritation, and allowing the escape of juices. Lafosse (1771) had very similar views and thought that exertion caused the circulation of lymph to stop and it then hardened. De Solleysel (1775) considered that confluence of cold humours on the part, which evaporated, leaving a hard mass, was the cause of spavin. Lymph was again mentioned by Von Busch in 1788, who postulated that it became thickened in the vessels, and gradually accumulated, due to inactivity or chilling. A more detailed account of how the juices were produced was given by Von Rohlwes (1801). He stated that an afflux of juices was produced by stretching of the ligaments, which then injured the membrane covering the bone, leaving it free to enlarge.

This theory seemed to lose popularity after this, and disease of the articular surfaces was noted and considered significant. Havemann (1805) was the first to notice this, and remarked that the lameness began when the articular surfaces of the flat tarsal bones became denuded of cartilage, they then began to grow together. This was corroborated by Dietrichs (1829) who also added that in many cases, an external swelling was unimportant and a horse could be very lame due to articular lesions, probably in the earlier stages of the disease, before ankylosis commenced. Gurlt (1831) also held this opinion, and agreed with Van Rohlwes idea that periosteal disease occurred prior to exostosis. He observed that central/third tarsal and third tarsal/metatarsal ankylosis were the earliest to occur. This was supported by Hering (1834) who asserted also that diseased articular cartilage could be found without lameness, and that in a visible spavin the articular surfaces are usually normal.

Schrader, in 1839, supported Havemann's views and commented as had Gurlt that the central/third tarsal articulation was affected first in most cases. The cartilage then suppurated and the bones became carious and eventually ankylosed. The exostoses were thought to appear after articular disease was well established. Bailey (1850) also/

also held the view that articular lesions were very important in spavin. In the same year, Hertwig reported that in some cases, the bony outgrowth on the medial side of the hock commenced as an acute inflammation of ligaments and primarily bone, causing erythema and porosis. The periosteum also became thickened.

By 1853, Gurlt had advanced his work and wrote that spavin was a chronic arthritis, affecting the central/third tarsal joint initially, then the ligaments and periosteum. Swelling and ankylosing exostosis occurred only on the medial aspect. The talus/calcaneus and talus/central tarsal articulation remained free even if surrounded by exostosis. Other ideas were advanced during this time, such as that of Bartels, who, in 1843, claimed that spavin originated in inflammation of the tendinous attachments of the hock joint. He also classified spavin differently to the conventional visible and occult, mentioning tarsal (upper part of the joint, with chronic lameness) and navicular (spavin in central/third tarsal articulation, without lameness) as the two forms he recognised. Lawrence, in 1850, considered that stiff joints or ankylosis arose from a wound, allowing synovia to escape and causing irritation and the production of extra bone.

In 1860, Schrader also considered spavin to be a chronic arthritis, the possibilities for its origin being threefold:-

1. In the cartilage due to continued trauma, leading to cartilage destruction, and eventually affecting the bone.
2. Disease of the synovial membrane causing a decrease in the amount of synovia in the joint, which caused cartilage damage.
3. Jarring causing disease of subchondral bone, resulting in disturbed cartilage nutrition and consequent necrosis.

Anacker (1864) also claimed that spavin was a chronic deforming and proliferative arthritis, in accordance with the usual theory of the time. Stockfleth, in 1869, considered that spavin may originate either in the ligaments, or the articular surfaces. A controversy/

controversy eventually arose as to which of these was the origin. However, Dieckerhoff, in 1875, had a different theory, he considered spavin to originate in the inner leaf of the bursa of the medial tendon of the tibialis anterior muscle, and then to spread to the capsular ligaments and periosteum of the joint causing a chronic synovitis, dissolution of cartilage and softening of bone marrow. He mentioned defective body structure, peculiar temperament, faulty histological setting of the joint and excessive exertion as aetiological factors.

After post-mortem examination of a large number of spavined horses, Gotti (1880) concluded that spavin originated in the bones of the joint. He found that the process usually began with an ostitis of central and third tarsal bones and the head of the metatarsus. Decalcification occurs, then a chondritis. Two stages were recognised, a destructive and a regenerative phase. If the regeneration and proliferation occurred on the articular surfaces, ankylosis could occur. He considered osteophyte formation to be secondary. Von Klemm (1887) considered excessive heel trimming to be responsible for hyperextension of the hock and hence strain of the attachments of the tibialis anterior on the hock. In a cow-hocked horse, the injury was mainly medial and constituted a spavin. To support this theory he claimed that of fifteen horses whose heels were trimmed very low, nine developed a spavin.

Dieckerhoff's views were supported by Hoffmann in 1892, who later altered his views and declared that spavin was an ostitis leading to lacuna formation. The theory that spavin began outside the joint was held by Pflug, who in 1892, commented that the exostoses were the primary lesion and arose from an ossifying periarthritis. Aronsohn (1893) also held this type of view, he considered that spavin began as a periostitis caused by injury to insertions of the tibialis anterior muscle, (similar to the theory of Von Klemm) and led to exostosis. Arthritis was mainly secondary and on lower articulations and the capsular ligament and synovial membrane were largely unaffected. He considered that there was very/

very little pre-degenerative articular cartilage proliferation, eburnation of bone was never seen and a partial osseous ankylosis of the bones was the end result.

The other view was held by Eberlein (1898), who asserted that spavin began in the subchondral bone of central and third tarsals and spread towards the articular surfaces which were subsequently damaged. Ankylosis was frequently found between bones, particularly central and third tarsals, usually only partial and always osseous. He held that the cause was pressure on the small bones of the joint, due to jumping, bad shoeing, heavy loads, etc. Faulty conformation, temperament and age were also thought to be important. Goldberg (1913) stated that Eberlein's view was the commonly held one at the time. Later, in 1918, he conducted a series of post-mortems and concluded that erosions and ankylosis were common lesions in many joints, particularly the hock. He noted that spavin may begin in the joint itself rather than the subchondral bone and that in many cases it may be due to infection.

Claims had been made by Cadeac (1908), and others, that arthritis was due to bacteria. Hare (1927) conducted an investigation into this, and concluded that bacteria found were contaminants in nearly all cases and that cartilage change was preceded by focal change in underlying bone. Eberlein (1898) also considered bacteria of no importance, having found none in 100 morbid joints.

Professor Mitchell of Edinburgh suggested in 1933 that osteoarthritic conditions of the horse, such as spavin, were related to other conditions such as laryngeal hemiplegia, shivering and partial paraplegia. He considered that these conditions could be accounted for by alterations from normal blood supply due to unknown noxious agents. By 1935 he modified this and considered that the cause was probably a peripheral neuropathy.

Andreewa in 1961, agreed to some extent with this theory and claimed that compression of the medial cutaneous nerve of the leg could produce arthrosis. As a result of this, spavin tended to occur in horses in which the nutrient artery of the tarsus had extensive/

extensive anastomoses with the skin and vessels accompanying this nerve. This was found in animals which had a primitive type of intertarsal union, with the talus articulating with central and fourth tarsals.

Little reference to the pathology of spavin is made until 1955, when Wamberg (1953 and 1955) commented that of 199 hock joints from 103 horses, only one horse proved to be free of joint lesions on the articular surfaces on examination of macerated bones. The joints were from horses considered sound pre-mortem. He stated that lesions varied from small defects to total ankylosis. The majority of lesions were found on the proximal surface of the third tarsal and distal surface of central tarsal. Most ankylosis was between these bones and in about 25% of hocks examined there was an osseous ankylosis of these bones. Lesions were usually bilateral but possibly of differing degrees. He thought that ankylosis was the end point if spavin was allowed to progress naturally. He considered the articular changes to be an arthrosis not causing lameness. The cause, he asserted, of lameness, was periarticular pain due to involvement of peripheral tissues medial to the gliding articulations of the hock. He defined spavin as a chronic, local periarthritis medially to the gliding articulations of the hock.

In his book, Dollar (1950) stated that spavin was an exostosis on the hock, below the level of the true joint, mainly on the inner aspect. Usually a chronic arthritis of the gliding joints also occurred, the talus and fourth tarsal rarely being involved. Ankylosis frequently ensued this process and was desirable as pain ceased and the animal became sound. He dismissed the theory of Dieckerhoff and considered that it began as an ostitis. Aetiological factors that he nominated were heredity, poor confirmation, overwork, particularly of young horses, violent movement, rheumatism and rickets.

The fact that 'spavin' was a term used to refer to several different pathological processes in the area of the small tarsal bones/

bones was noted by Schebitz (1965). The processes he names were arthritis, chronic deforming arthritis, arthrosis deformans, aseptic bone necrosis and periostitis ossificans. Rooney (1969) considered that occult spavin was the early stage of a 'visible' type Spavin; disagreeing with Smith (1893). The development of this lesion was attributed to asynchronous movements of the tarsal bones, similar to Peter's theory. This could be exacerbated by poor conformation. According to his theory, a thoroughbred should be predisposed to third tarsal/metatarsal lesions and a jumper to central/third tarsal lesions. In 1974, Adams asserted that spavin was due to poor conformation (sickle, cow or weak hocks), or trauma, particularly that created by quick stops when roping, etc. Mineral imbalances, e.g. rickets, are suggested as predisposing causes.

IV. <u>Treatment</u>

The treatment of spavin in horses has changed considerably since first attempted, and varying degrees of success have been claimed for the different procedures.

As early as 1594, Greene and Lodge wrote "If he have outward diseases as the spavin, splent, ringbone, be let him blood". A little later, in 1639, Thomas de Grey appreciated that a cure could be difficult to effect, saying "This malady is not easily cured, but with great difficulty and danger". He also recommended bleeding, from the thigh-vein, then rubbing the swelling hard with petroleum, using a rolling-pin for four days. This was followed by incising over the spavin and applying a bruised herb called Flamula for two days more. The area was then blistered with cantharides and eufabium until the bone-crust is bared. The next stage recommended was to apply "Fearne-roots, hounds-tongu, and bore-grease" until the crust could be loosened and removed, the wound then being healed with green ointment.

This complex and dangerous method had been replaced by blistering and firing when Gibson wrote in 1751. He recommended blisters/

blisters mode of euphorbium, arsenic, corrosive sublimate, or Spanish fly. He re-applied blister fortnightly on six or seven occasions in some cases, working the horse lightly and administering diuretics at the same time. In an occult spavin, or a spavin in an older horse, he considered firing and/or a very strong blistering to be a possible treatment, but commented that it may only serve to prevent further development. In his opinion, these cases were best managed by gentle work and mild blistering over a long period. In cases of very obstinate spavins, he remarked that very bold attempts had been made to cure them, often only causing pain to the horse and with poor results.

Methods available for the treatment of bone spavin were more numerous when Mayhew wrote in 1888. He suggested that any spavined horse which was not lame should be left alone. Lame horses could be treated in various ways, including the use of purges and diuretics, a rowel or seton, or bleeding, blistering, firing, punching, or the operation of periosteotomy or neurotomy. All these treatments were considered to be excessively painful to the horse and he suggested that affected horses of low value should be slaughtered. More valuable horses, he suggested, should be rested, fed well, and mild blister applied, as suggested 130 years earlier by Gibson.

Similar views that rest, blister and firing were the only valuable treatments, were held by Smith (1893). He reports no success in cunean tenotomy or attacking the joint surfaces. In his opinion, in cases of articular disease, the ability to surgically attack the joint surfaces and set up a reparative process was necessary to effect a cure. The traditional methods were again mentioned by Share-Jones in 1904, who considered that blistering and firing hastened the inflammatory process and hence tended to promote ankylosis. He had found firing to be fairly successful, using pointed iron which was pushed into the exostosis, then the area was blistered. The use of a seton or rowel coated with blister and inserted subcutaneously was also mentioned.

The method of cunean tenectomy and scraping the underlying area,/

area, then blistering, was noted as an alternative, with a similar object to pyropuncture. Share-Jones also claimed a fair degree of success with this operation. A modification of this concept was employed in the periosteotomy operation, in which the covering of the exostosis was slit to relieve the pressure of the exostosis on overlying sensitive structures. Simple cunean tenectomy was employed also, the originations of this procedure were Abildgaard and Lafosse. (cited by Share-Jones) The aim of this was to relieve pressure on the diseased area. Share-Jones had variable success with this technique and attributed many of his failures to two factors:-

(a) Displacement of the tendon during exostosis formation, which then did not run over the exostosis.

(b) Accommodation of the tendon in a groove in the exostosis.

A further modification of this was used by Peter (cited by Share-Jones) who cut the subcutaneous tissues, cunean tendon, periosteum and superficial bone with a slightly curved knife, pressed hard into the underlying tissues in two places, forming a V-shaped cut through the tissues. The area was then bandaged and the horse rested for 4-6 weeks. Suchanek (1928) (cited by Wamberg 1955) gives a recovery rate of 70% for Peter's operation. Dykstra (1913), also referred to Peter's operation and another variation used by Dieckerhoff, which was suitable for use in cases where the cunean tendon was embedded in the exostosis and inaccessible to Peter's knife. The cunean bursa was opened and the cunean tendon severed, but no part removed in this technique.

The use of sharp point firing was suggested by Dykstra for cases where the exostosis was too large to allow direct access to the cunean tendon, or other procedures had failed. Moller-Sorensen (1949) (cited by Wamberg 1955) quotes a recovery rate of 60% after penetrating needle cauterisation. Tibio-peroneal neurectomy was mentioned by several authors (Dykstra, 193; Share-Jones 1904; Mayhew 1888) as a possible last resort in spavined horses.

Degenerative/

Degenerative changes were likely to follow this operation, which made it basically undesirable. Dollar (1950) mentioned the conventional treatments.

The next advance was made by Wamberg in 1953, who suggested his operation, a "peripheral neurectomy" of the nerve branches sensory to the area of spavin exostosis. This is achieved by cutting through, in a diamond-shaped pattern, all tissues around the exostosis, including tendons, ligaments, periosteum, etc. A double bladed knife is used for this operation. Wamberg considered that the significant part of this operation was the cutting of the nerve supply, rather than any other structures, which are merely coincidental. He claimed that this operation was inspired by Berge's local infiltration of the area, which caused pain and lameness to disappear. Post-operative care of the horse included exercise to ensure functional adaptation of the scar tissue. Wamberg regards this as critical for the success of the operation. He gave figures for his success rate which corroborate this statement:-

Of cases treated correctly post-operatively - 31 cases cured and 3 not cured.

Of cases treated incorrectly - 3 cases cured and 9 not cured.

Schebitz (1965) mentioned the importance of corrective shoeing for spavin, to support the heel and induce an early breakover. The methods he suggested were, shortening and rolling the toe, thickening the branches, or using leather wedges for elevation. A full outer branch or trailer could be used. Adams, in 1974, also mentioned the importance of shoeing and suggests, in addition, an open medial toe shoe, made by welding a steel rod on the inside edge of the ground surface of the shoe, leaving a gap in the medial toe area. The use of a bar across the heels or turning back the heels was suggested for standardbred trotters.

Schebitz went on to state that there were several basic lines for treatment that could be followed:-

1./

1. Use of anti-inflammatory and analgesic drugs in conjunction with the degree of work (if any) that the animal was capable of, but not excessive work.
2. Hyperaemic methods. This includes firing and blistering. In his opinion, firing into the joint space was a hazardous procedure and may only serve to increase lameness. He suggested that cutaneous point firing may be useful and that a blister should be applied afterwards and the area bandaged for protection and support. The animal should then be rested for six weeks.
3. Surgery. In this operation he mentioned the Peter-Schmidt technique and Wamberg's operation. He considered that Wamberg's theory that his operation produced a peripheral neurectomy was incorrect and claimed that the nerve fibres regenerated rapidly. He remarked that all surgical procedures were based on the same principle and differed only in extent of separation of ligaments. The criteria for a case suitable for surgery, were, in his opinion, that there was largely ligamentous damage rather than joint change, and that post-operatively the ligaments were extensively severed. In agreement with Wamberg, he suggested work in the immediate post-operative period, beginning at three days post-operatively.

The most recent advance in treatment has been made by Adams in 1971, he suggested drilling out the articular surfaces of affected joints. The reason that this was attempted was that he considered that once a joint was osteoarthritic, lameness continued until ankylosis ensued. This operation was an attempt to hasten the ankylosis. He suggested that at least 60% of the articular cartilage should be destroyed in both distal intertarsal and tarso metatarsal joints, also in proximal intertarsal if it was involved.

A cunean tenotomy is done routinely as part of this operation, the joint spaces are then identified by using a needle and radiographs if necessary, to confirm position and then a drill bit used to destroy/

destroy the joint surfaces. Bone grafts from tuber coxae may be inserted. In cases of bilateral spavin, he suggests that both hocks are treated during the same anaesthetic. Post-operatively the hock should be bandaged and box rest for thirty days, with light riding after this time, gradually increased. He claimed to have treated 13 horses successfully by this method (7 unilateral and 6 bilateral), most having been subjected to previous treatment, without success. The total number of horses operated on was not stated.

Slight modifications of this technique have been used. Mackay & Liddell (1972) removed the articular cartilage, then immobilised the articulations with steel pins. Only one horse was reported upon, a twenty-one year old stallion, but he was claimed to be almost sound six weeks later. Hickman (personal communication) used a similar technique, and inserts a compression screw from the medial side of the head of the metatarsus, up through the joints, in an attempt to produce compression after removal of cartilage.

Rooney (1972) and Gill (1973) mention firing, blistering, various forms of cunean tenotomy and tenectomy and arthrodesis as treatments. Gill commented that ankylosis may be stimulated by working the horse on anti-inflammatory drugs.

In 1972, Grande surveyed the results of treatment by Wamberg's method, cunean tenectomy and conservative treatment, in 58 horses, all trotters. The criterion takes to indicate success was the completion of a race, within about a year of treatment, without disqualification for incorrect trotting. She found that the recovery rates were as follows:-

(a) Wamberg's operation - 69.5%
(b) cunean tenectomy - 73.3%
(c) conservative treatment - 60.0%

The cases in the conservative treatment group either received no treatment, or blistering in a few cases. The difference in success rate between groups (a) and (b) was considered to be statistically insignificant.

Grande/

Grande reports that Zeller (1968) found a recovery percentage, using Wamberg's operation, of 50%, and Dietz et al (1969) compared, using achievement criteria, the use of firing and blistering with Wamberg's operation in trotting horses. Their recovery rates were 76% and 55% respectively. Radiological change was present in all of Grande's material, whereas in Zeller's material, only about half had radiological changes. Grande concluded that there was a better chance of recovery if surgery was attempted, but the results obtained were similar with Wamberg's operation or cunean tenectomy.

Prognosis

Many different theories have been advanced regarding the likelihood of a spavined horse recovering or being cured. These theories were based on the site of the lesion, age of the animal, treatment applied, and various other factors.

De Grey, in 1639, observed that the cure of spavin was very difficult, but considered it possible in some cases. Gibson, in 1751, commented that a spavin low down on the hock was not so dangerous as a high one, nor was a spavin "near the edge" of the hock as bad as one "towards the middle", as it had less effect on the bending of the leg. He also considered that a spavin arising from a blow was less dangerous than one arising spontaneously, and a spavin in a young horse was not as serious as one in a mature horse or an old horse. In the latter case it was said to be seldom curable. Older horses, he said, tend to develop spavins deeply situated in the joint and hence inaccessible and difficult to diagnose.

Mayhew made a similar observation in 1888, that high spavins produced an incurable lameness, and low ones were less problem. Smith (1893) also took this view and said that if the talus or metatarsus became involved, ulceration tended to occur rather than ankylosis and exostosis, hence a cure was very unlikely. Articular, as he called it, or ulcerative spavins, were regarded to be incurable. As/

As long as only the first and second, third and central tarsals were involved, then he considered the chances of recovery good. The prognosis of spavin lameness was considered favourable in most cases by Dykstra in 1913, but he regarded certain factors as indicative of a poor prognosis. These were:-

1. Older animals.
2. A large exostosis far forward on the articulation, which may produce mechanical lameness.
3. Chronic cases on which several treatments have been attempted.
4. Animals with strangled hocks.
5. Hard-working animals with an inherited tendency to spavin.

Dollar (1950) and Rooney (1972) considered that about two-thirds of cases eventually became sound due to ankylosis occurring and ostitis ceasing. Occult spavin, he said, was not likely to result in ankylosis and was thus often incurable (in agreement with Smith). He also considered high up and far forward spavins worse, agreeing with Gibson and Mayhew's views.

Adams, in 1970, remarked that the prognosis for spavin cases was better if only distal intertarsal and tarsometatarsal joints were involved, and worse if the proximal intertarsal joint were involved. Some earlier workers, e.g. Smith, had considered the involvement of the head of the metatarsus to decrease the likelihood of recovery.

SURVEY OF CLINICAL MATERIAL

MATERIALS and METHODS

This survey was conducted to investigate the eventual outcome of cases of "spavin" seen at Glasgow University Veterinary School between the years 1972 - 1977. In most cases it was impossible to examine the animal and therefore the case was evaluated solely on the owner's remarks.

A survey questionnaire was sent out to 24 owners of horses diagnosed as being affected by bone spavin at Glasgow University Veterinary School between 1971 and 1976. Of these, three are not included in the results table; two because no reply was received, and there was insufficient information in the records, and one because the animal had been shot and at post-mortem found to have normal hocks and osteoarthritic hip joints. Other animals are also included in the results table, these were:-

3 animals known to have been destroyed because of lameness caused by "spavin".

5 clinical cases seen for the first time during 1977.

4 post-mortem specimens obtained from affected animals which had been examined during life.

Replies were received from 19 owners. In some cases information is incomplete, thus there is a discrepancy in total numbers involved in results showing different features of the disease. The information in the table was collected from study of clinical records and radiographs of past cases, the replies to the questionnaire and in some cases observations made on examination of the animal by the author. Twelve of the clinical cases were seen at some time by the author and all four of the animals from which post-mortem specimens were obtained were examined prior to death.

A total of 33 animals are included in the survey.

RESULTS OF CLINICAL SURVEY AND TABLE GIVING DETAILS OF CASES.

Fig. A.

This table gives details of the horses in the survey of clinical material.

SURVEY OF CLINICAL CASES OF TARSAL OSTEOARTHRITIS

Identification	Age (years)	Sites of Radiographic change	Externally visible exostosis	Treatment	Clinical Signs and Outcome
1	5	Left dorsal ankylosis Distal intertarsal joint Talus peaking Right dorsal exostosis talus calcaneus articulation. Lateral T4 Dorsal medial		Conservative	Swelling Lame ++ Deteriorated Destroyed
2	5	Right distal intertarsal joint dorsal medial		Cunean tenectomy	Lame + Right
3	7	Left + Right exostosis		Conservative	Bilateral Lame + Became sound, but on work lame at times.
4	8	Left distal intertarsal joint, central tarsal peaking. Right dorsal medial distal intertarsal joint lysis exostosis	+	Left - Wamberg Right - Arthrodesis	Lame right, sound now but still stiff initially.
5	7	Left + Right dorsal medial distal intertarsal joint + tarso metatarsal joint. Ankylosis distal intertarsal joint.	+	Left + Right Wamberg	Lame + Left & Right Became sound. Refused to jump, bad ride so destroyed.

6/

Identification	Age (years)	Sites of Radiographic change	Externally visible exostosis	Treatment	Clinical Signs and Outcome
6	6	Left dorsal medial distal intertarsal joint. Right distal intertarsal joint.		Right-Wamberg	Lame ++ Sound now.
7	8	Left distal intertarsal joint ankylosis. Dorsal medial exostosis.		Left-Wamberg	Lame + Sound now, no external enlargement visible (see Fig. 39)
8	9	Left tarso metatarsal joint + metatarsal 4 lateral. Right tarso metatarsal joint + distal intertarsal joint.		Left-Arthrodesis distal intertarsal joint, tarso metatarsal joint lateral approach. Right-Wamberg	Lame. Improved initially, but then deteriorated. Destroyed. Right leg became worse. Foreleg lameness.
9	7	Right distal intertarsal joint, dorsal medial.		Right-Wamberg	Lame + Now sound.
10	9	Left exostosis dorsal medial, distal intertarsal joint, tarso metatarsal joint. Right exostosis medial, tarso metatarsal joint, distal intertarsal joint.	+	Left + Right Wamberg	Lame + Now sound, with large spavin exostose both legs.
11	23	Right lysis distal intertarsal joint, dorsal medial.		Conservative	Lame. Outcome unknown.

12/

Identification	Age (years)	Sites of Radiographic change	Externally visible exostosis	Treatment	Clinical Signs and Outcome
12	?	Right proximal intertarsal joint - edge reaction and radio-opaque body dorsally. Osteochondritis dissecans or chip fracture		Conservative	Lame. Outcome unknown.
13	6	Right second and third tarsal articulation. Tarso metatarsal joint, dorsal medial.		Conservative	Was also affected in tibio-tarsal joint. Became sound.
14	5	Right distal intertarsal joint and tarso metatarsal joint, dorsal medial.		Conservative	Lame Right. Had been involved in accident. Became sound.
15	?	Left Right-partial ankylosis distal intertarsal joint		Conservative	Unknown.
16	6	Left-loss joint space distal intertarsal joint. No edge reaction. Right-loss joint space distal intertarsal joint, less marked.		Conservative then Left Arthrodesis distal inter-tarsal joint, tarso metatarsal joint.	Lame - "Stiff" at times. Improving 2m post-op.

17/

Identification	Age (years)	Site of Radiographic change	Externally visible exostosis	Treatment	Clinical Signs and Outcome
17	9	Left distal intertarsal joint, mild exostosis progressed to ankylosis.		Conservative	Lame-Left. Rested - became sound.
18	8	Right distal intertarsal joint, tarso metatarsal joint progressed to partial ankylosis.		Conservative	Lame-later found to have tibio-tarsal changes and brucella. Destroyed.
19	12	Left ankylosis, distal intertarsal joint			Sound. Hocks obtained at post-mortem. Destroyed (Figs. 16-18)
20	11	Left exostosis proximal intertarsal joint, distal intertarsal joint, tarso-metatarsal joint, dorsal medial. Distal intertarsal joint ankylosis. Right exostosis distal intertarsal joint, tarso metatarsal joint, dorsal medial. Distal intertarsal joint ankylosis.	+	Conservative	Lame left+Right. Hocks obtained at post-mortem. Destroyed. (Figs. 5-6)
21	9	Left proximal intertarsal joint, distal intertarsal joint loss of density. Distal intertarsal joint ankylosis. Right distal intertarsal joint ankylosis.	+	Conservative	Lame left. Hocks obtained at post-mortem. Destroyed. (Figs. 12-15)

Identification	Age (years)	Site of Radiographic change	Externally visible exostosis	Treatment	Clinical Signs and Outcome
22	5	Left distal intertarsal joint ankylosis.			Sound. Hocks obtained at post-mortem. Destroyed. (experimental pony)
23	5	Exostosis on talus or sustentaculum tali.			Lame + Destroyed
24	9	Left exostosis proximal intertarsal joint, distal intertarsal joint, tarso metatarsal joint. Partial ankylosis distal intertarsal joint, lysis in proximal intertarsal joint. Right distal intertarsal joint, tarso metatarsal joint.	+	Firing then Wamberg right +left, then left arthrodesis proximal inter-tarsal joint, distal intertarsal joint, tarso metatarsal joint Right arthrodesis distal intertarsal joint, tarso metatarsal joint.	Lame ++ Left hind. Lame + Right hind. Reported to be improving post-arthrodesis. (Figs.19-2
25	.5	Left dorsal medial distal intertarsal joint + tarso metatarsal joint. Right dorsal medial distal intertarsal joint.		Left+Right arthrodesis, distal intertarsal joint, tarso metatarsal joint.	Lame + Left. Doing well 6 week post-op.

26/

Identification	Age (years)	Site of Radiographic change	Externally visible exostosis	Treatment	Clinical Signs and Outcome
22	5	Left distal intertarsal joint ankylosis.			Sound. Hocks obtained at post-mortem. Destroyed. (experimental pony)
23	5	Exostosis on talus or sustentaculum tali.			Lame + Destroyed
24	9	Left exostosis proximal intertarsal joint, distal intertarsal joint, tarso metatarsal joint. Partial ankylosis distal intertarsal joint, lysis in proximal intertarsal joint. Right distal intertarsal joint, tarso metatarsal joint.	+	Firing then Wamberg right +left, then left arthrodesis proximal intertarsal joint, distal intertarsal joint, tarso metatarsal joint Right arthrodesis distal intertarsal joint, tarso metatarsal joint.	Lame ++ Left hind. Lame + Right hind. Reported to be improving post-arthrodesis. (Figs.19-2[illegible]
25	.5	Left dorsal medial distal intertarsal joint + tarso metatarsal joint. Right dorsal medial distal intertarsal joint.		Left+Right arthrodesis, distal intertarsal joint, tarso metatarsal joint.	Lame + Left. Doing well 6 week post-op.

26/

Identification	Age (years)	Site of Radiographic change	Externally visible exostosis	Treatment	Clinical Signs and Outcome
26	11	Left distal intertarsal joint, partial ankylosis. Right distal intertarsal joint, partial ankylosis (more advanced)	+	Conservative	Lame left. Result unknown as yet.
27	5	Right distal intertarsal joint + tarso metatarsal joint, partial ankylosis.		Conservative	Lame right. Worked on phenylbutazone and became sound at most times.
28	8	Left distal intertarsal joint, partial ankylosis, tarso metatarsal joint.		Left+Right Wamberg	Lame right. Outcome unknown as joint became infected 4 months post-op and animal destroyed.
29	6	Left distal intertarsal joint, partial ankylosis. Right exostosis distal intertarsal joint, tarso metatarsal joint. No loss joint space except dorsal medial edge.	+	None	Moved badly. Had never been lame during the development of the lesion. Large exostosis right.

30/

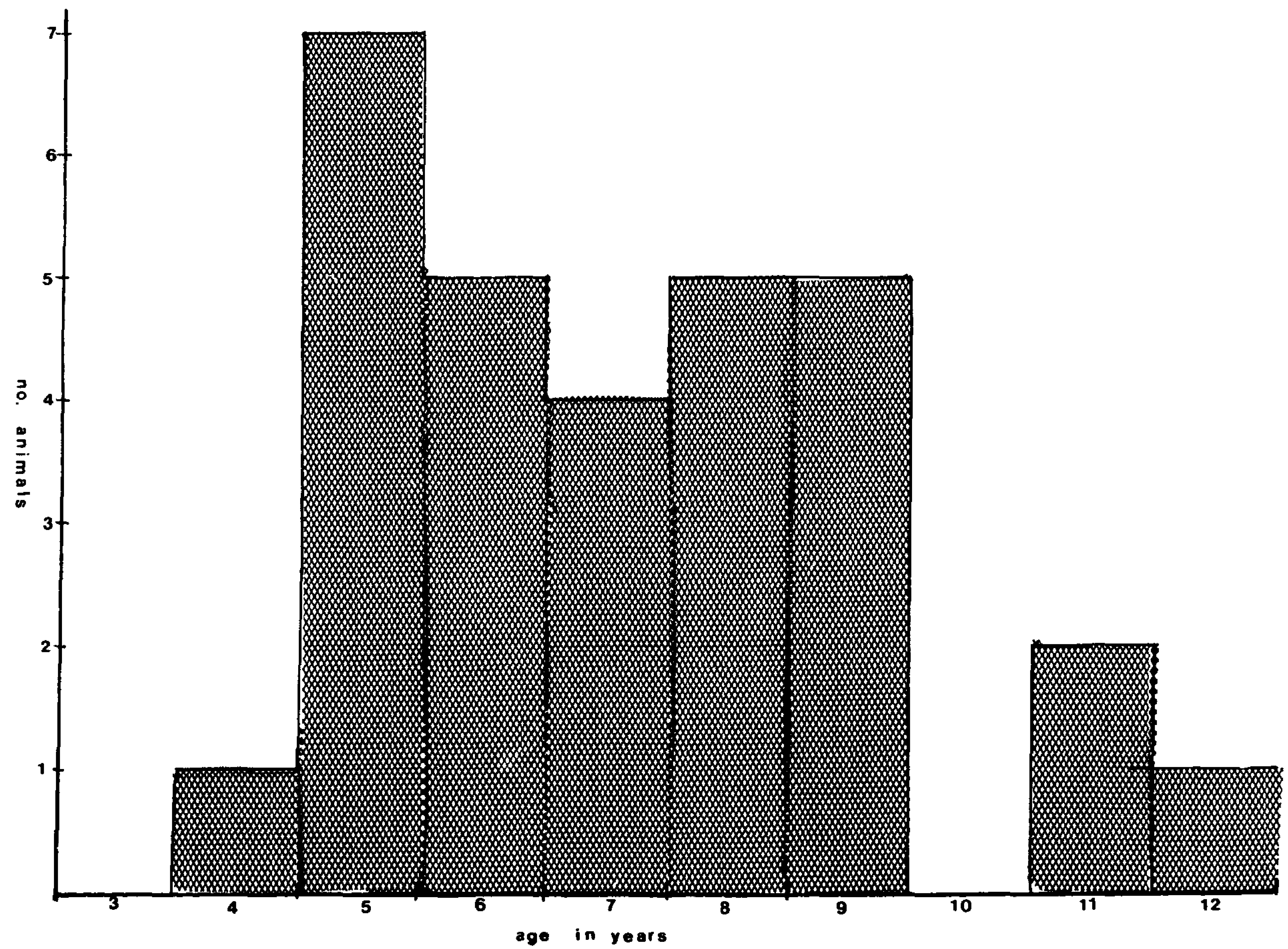
Identification	Age (years)	Site of Radiographic change	Externally visible exostosis	Treatment	Clinical Signs and Outcome
30	8	Left exostosis distal inter-tarsal joint, tarso metatarsal joint. Right exostosis distal inter-tarsal joint, third tarsal involvement extensive.		Left+Right cunean tenectomy then left+ right Wamberg.	Lame+Right. "Shuffling" action. Improved after second op. Still lame.
31	7	Left distal intertarsal joint Right distal intertarsal joint (less marked)		Left+Right Wamberg	Lame left. After op., improved became sound. Stiff occasionally.
32	4	Left mild dorsal medial distal intertarsal joint. Right mild dorsal medial distal intertarsal joint.		None	Not lame but positive spavin test right. Moved badly.
33	6	Left distal intertarsal joint articular. Right distal intertarsal joint edge.		None	Not lame. Moved very badly, very poor hock conformation. (Fig.30)

Fig. 8.

Histogram showing age incidence of tarsal osteoarthritis.

In addition to the horses shown on the table, one was 23 years old and two of unknown age.

AGE INCIDENCE OF TARSAL OSTEOARTHRITIS



CLINICAL SIGNS

The clinical signs noted in the animals examined during the course of this survey were numerous. The most commonly noted features were:-

1. Positive "spavin test". This was noted in at least one leg of all the animals examined which were lame. In those which were sound at examination (long-standing cases) this was not noted in most cases. However, this sign was also seen in animals with other hock diseases, and hip or stifle lameness.
2. Badly conformed hocks and poor action. This was a feature of many animals affected by tarsal osteoarthritis.
3. Dragging or "driving into the ground" the toe of the hoof, producing a "square-toed" effect if the animal had been recently worked.
4. Lameness of variable degree was present in most cases at some stage of the disease, usually the early stages. If lameness was long-standing and of moderate degree, gluteal atrophy was present. On exercise, lameness usually improved or remained the same.
5. Enlargement on the dorso-medial aspect of the hock. This was noted to an obvious extent in 8 animals. There may have been others which were less marked.
6. The onset of lameness was reported to be sudden in some cases, but was gradual in most, progressing from stiffness to frank lameness.

Results of Treatment:

	Successful	Unsuccessful	Unknown
Conservative	5	5	4
Cunean Tenotomy	0	1	1
Surgical - Wamberg	6	3	1
Arthrodesis	1	1	3

6 animals, untreated, Nos. 16, 24, 30, 8, appear twice.

Limb Affected - Radiographically/

Limb Affected - Radiographically

	Left	Right	Both	Unknown
	6	8	18	1

In most cases lameness was unilateral. This may have been due to the fact that one limb was more severely affected and thus more painful and was favoured.

Age at Presentation

This is shown in the histogram, Fig. B. In many cases, the condition had been present for a year at presentation; thus the age at which lameness first occurs is frequently younger than indicated.

Effect of Age on Success of Treatment

The majority of the cases seen fell into the age range 5-9 years. All cases treated were in this range, except for one animal aged 11 treated conservatively, the results of which are not yet known. The age of the animals treated appeared not to affect the result of treatment. The duration of lameness before referral is not known in all cases. Some of the animals which had been lame for 1-2 years had severe lesions and the talus was involved, they responded poorly to treatment, or were regarded as untreatable. Other cases had only mild changes after this period of lameness.

Work Done by Affected Animals

Showjumper	2
Eventer	5
Hack/Riding School	11
Hunter	8
Show pony	1
Gymkhana pony	1
Unknown	5

Most of the animals were of mixed breed, 5 were Thoroughbred, and 4 were half or three-quarter bred. Thus, the work done by the/

the animal does not seem to influence the likelihood of developing tarsal osteoarthritis. The relatively high number of hacks developing the condition is probably due to the relatively high proportion of horses falling into this class.

From examination of the table, Fig. A, it can be seen that the majority of animals affected by tarsal osteoarthritis had basically similar changes on radiographic examination. The cases which did not return to soundness showed features in common, including involvement of lateral and dorsal aspects of the joint and change on talus and calcaneus. These alterations were not seen in animals which became sound.

The poor conformation noted in the hocks of many animals included sickle hock, cow hock, straight hocks, very weak, tied-in hocks and various combinations of these faults. A feature commonly noted in affected horses during locomotion was the description of a curved arc by the hind feet, when the animal was viewed from behind. During the weight-bearing phase in some animals, the foot was also rotated in a screw-like manner.

PATHOLOGY

1. MATERIALS and METHODS

The gross lesions of tarsal osteoarthritis were investigated. The joints of 3 affected animals were examined fully at post-mortem. In addition, the macerated hock of one affected pony was examined without prior dissection of soft tissue structures.

Changes were also seen in 4 horses which did not show any clinical sign of tarsal osteoarthritis. These are described along with features noted during surgery in 2 cases.

Affected joints examined at post-mortem were from:-

No. 21 A 9 year old thoroughbred gelding, who had been lame for some time prior to destruction, due to bilateral tarsal osteoarthritis. No attempt had been made to treat him surgically. (horse 1)

No. 19 A 12 year old mare with chronic obstructive pulmonary disease, who was initially radiographed as a "normal" as she had no clinical signs of the disease; she was found to be affected radiographically in the left hock. The right hock was apparently normal on radiographs, but was not available for dissection post-mortem. (horse 2)

No. 20 An 11 year old cob gelding, lame in both hind legs because of tarsal osteoarthritis. He had been lame for a considerable time prior to destruction, and had not been treated surgically. (horse 3)

No. 22 A 5 year old pony gelding, who was sound, did not have any external sign of tarsal osteoarthritis, and did not react to the spavin test.

Examination of soft tissue was not carried out in this case and no previous history is known. Tarsal osteoarthritis was found on examination of the macerated bones of the left hock. (horse 4)

The joints of horses 1, 2 and 3 were obtained fresh, and dissected. They were first skinned, then the subcutaneous fibrous tarsal fascia removed to expose the tendons and ligaments around the joint. The cunean tendon was identified and examined for change/

change in position or appearance. This was then sectioned, and the underlying bursa examined. The tibio-tarsal joint was opened and the surfaces scrutinised. The closely attached ligaments of the intertarsal joints were sectioned and removed as far as possible to expose the articular margins for examination. The joints were then boiled out and degreased to remove soft tissues and expose the bone surfaces.

Fused bones were sectioned vertically, on a bond saw, cutting a cross-section of the joint to examine the remnant of articular surface. The cut was commenced where a remnant of articular surface was visible.

2. RESULTS

Dissection of Affected Joints

Horse No. 1

On dissection, thickening of the ligaments and fibrous tissue of the hocks were found, being most marked on the dorso-medial aspect of the joint. The fibrous tissue was even more closely adherent than usual to the joint edges of the intertarsal joints. Irregular new bone could be felt with the scalpel blade beneath this tissue. The cunean tendon was slightly distorted in position, being pushed outwards by the fibrous reaction. Both hocks were similarly affected, the left more obviously than the right.

The central, third and second tarsals of the severely affected hock (left) were ankylosed. The dorsal aspect of the distal articular surface of the talus and proximal surface of third tarsal were affected by extensive cavitation (Figs. 12, 13), particularly on the medial aspect. There was some exostosis on the dorsal and medial aspects of these fused bones, this was very irregular and showed a minor degree of cavitation extending into the bone. There was also exostosis around the distal part of talus. Exostosis was also present around the margins of calcaneus and fourth tarsal.

The right hock showed ankylosis of central and third tarsals, with the joint edge remaining medially. There was an area dorsally of what appeared to be ossification along the lines of ligamentous attachment (Fig. 13). The proximal articular surface of the central tarsal was grooved along the dorsal margin, as was the corresponding area of talus. Both hocks had a marked synovial fossa in the groove between the trochlear ridges of the talus, extending along almost its whole length, and a corresponding defect in the ridge of the distal tibia.

The first and second tarsals were not united and were present as separate elements in the right hock. In the left hock, the second tarsal was fused to the ankylosed parts and the first was separate. (Fig. 13) On sectioning, both distal intertarsal joints were found to be fused over most of their surfaces. There was a cavity/

cavity in the centre of the fused bones, where part of the non-articular area of the surface is found in a normal joint. This cavity communicated with a foramen, suggesting that it may have contained blood vessels.

There was a remnant of joint space extending from the dorso-medial edge inwards (Fig.13B) in the right hock, and a small area of joint space in the centre of the bones of the left hock.

Horse No. 2

This animal showed only a slight degree of thickening of the ligaments in the left hock. The cunean tendon was present and not abnormal. It was possible to expose the area of the distal intertarsal joint, and, as was suspected from the radiographic appearance of the joint (Figs. 17, 18) during life, no joint was evident.

After maceration, the central, second and third tarsals were seen to be almost totally ankylosed. The ankylosis was perfect laterally, and there was a shallow remnant of a joint edge medially (Fig. 16). Ossification along the lines of attachment of ligaments could be seen dorsally. The second tarsal was united to the third, but the joint space was not completely obscured (Fig. 16). The first and second tarsals were not united. There was no change on the talus or calcaneus, or head of metatarsus.

The right hock was unfortunately not available for dissection, but was thoroughly assessed radiographically during life, and considered to appear normal, with united first and second tarsals. On section of the bones, the area of fusion and the appearance (Fig. 16B) was similar to that of the right hock of horse No. 1.

Horse No. 3

On dissection, these joints showed gross thickening of the ligaments on the dorso-medial aspect of the hock and distortion of the cunean tendon and its bursa. The tendon appeared stretched and distorted in both hocks. The fibrous tissue reaction left the tendon in a shallow groove, rather than lying on the surface of the ligamentous tissue. The bursa was compressed by the underlying exostosis and fibrous tissue.

On examination of the macerated bones, the following was found:- (Figs. 5, 6)

Left hock:- extensive periarticular exostosis on third metatarsal, central, third and first and second (fused) tarsals, mainly on the dorso-medial and dorsal aspects of the joint. A large exostosis involved medially the heads of second and third metatarsals, and the central, third and first and second tarsals. There was a lesser/

a lesser degree of exostosis on talus, calcaneus and fourth tarsal. The central and third tarsals were fused, and the third tarsal was fused to the metatarsus by the medial exostosis and small areas of ankylosis around the joint.

The right hock demonstrated basically similar changes but to a lesser degree. The central, third and fused first and second tarsals were also ankylosed completely, but with less periarticular exostosis. There was again a large medial exostosis. On the plantar aspects there were small areas of ankylosis uniting third tarsal and metatarsal. There was only a very minor degree of change on talus, calcaneus and fourth tarsal.

The only change of proximal intertarsal joint surfaces on either leg was slight grooving. There were bony spurs around the edges of this joint on the left hock.

The fused central and third tarsals and metatarsus were sectioned just anterior to the large medial exostosis on both legs, and the cut made straight to the plantar aspect of the bones (Fig. 6B). In the left hock, there was a remnant of joint space dorsally, and also on the plantar aspect of the distal intertarsal joint. The central section was ankylosed, this being about 25% of the surface. There was no cavity evident but no other sections through the bone were made. The tarso-metatarsal joint was fused by the exostosis, but the majority of the visible joint surface was not affected.

In the right hock, there was a remnant of joint space dorsally, and the remaining 60% was ankylosed. No cavity was evident on this section either. The tarso-metatarsal joint was fused mainly by the exostosis, the joint space being discernible throughout its length.

<u>Horse No. 4</u>

The hocks of this horse were not dissected prior to maceration of the bones. The macerated bones revealed that the left hock had total ankylosis of central, third, first and second tarsals. The joint space between second and third tarsals was still visible, but the distal intertarsal joint space was not. There was a minor degree of periarticular reaction medially. The articular surfaces of/

of the proximal intertarsal joint were normal, except for a pinhead sized depression in the subchondral bone on the medial part of the joint surfaces of both bones and grooving of the bones just behind the dorsal articular margin. The metatarsus was normal, as in horse No. 2 which had similar changes. The other hock was also macerated and was normal.

On sectioning the fused central and third tarsals, fine remnants of joint space were visible on the centre of the bones and the surface of the distal intertarsal joint was about 75% fused. A small cavity was evident in the non-articular area (Fig. 6C). This also communicated with a foramen, as in horse No. 1.

The figures opposite show the macerated hock bones from pony no. 3, which was affected by bilateral tarsal osteo-arthritis. The left leg was clinically worse.

Fig 5.

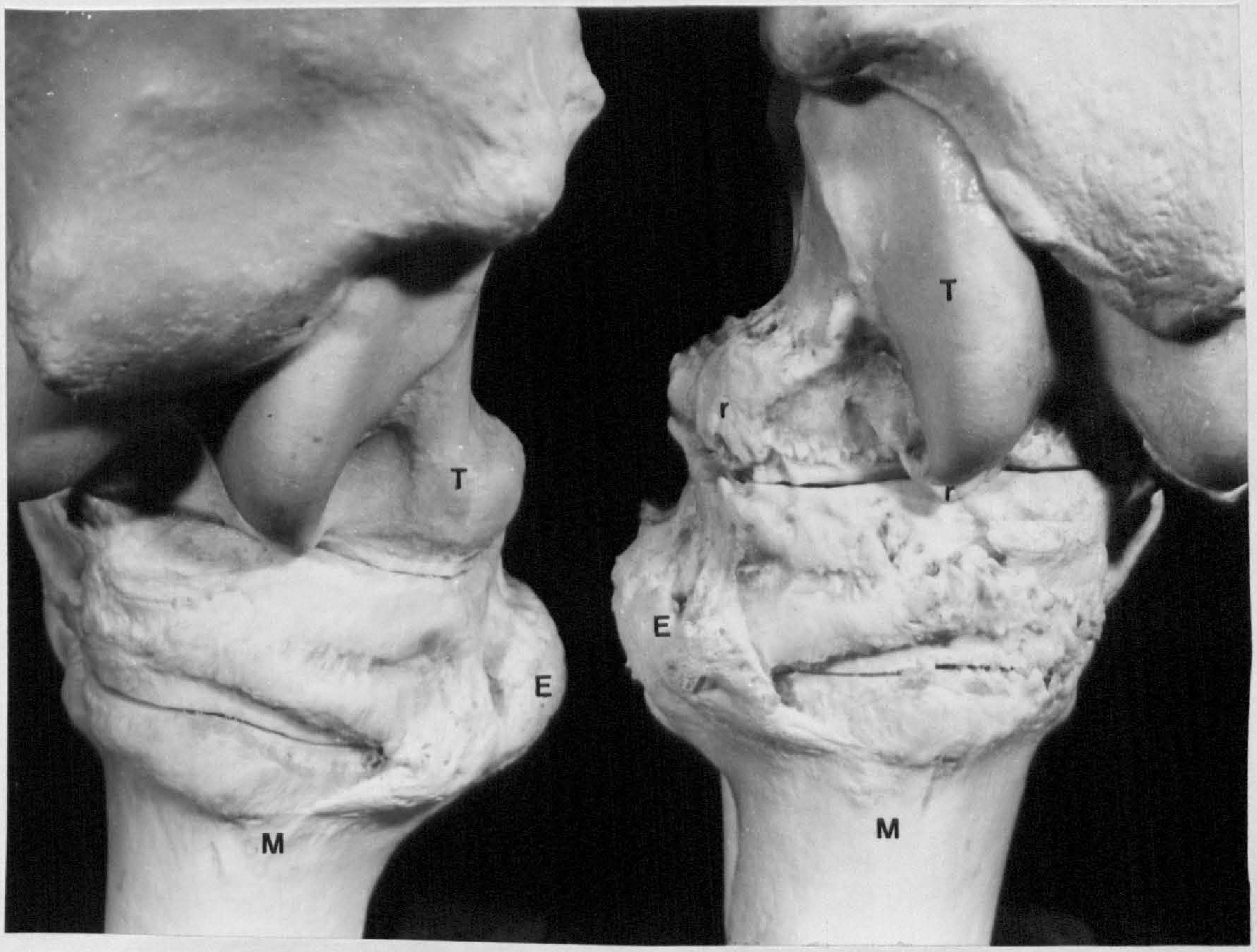
This is a view of the dorsal aspect of both hocks. The left hock is on the right of the photograph, and the right hock on the left. Both have a large exostosis(E) on the medial aspect of the distal intertarsal and tarso-metatarsal joints. There is exostosis and roughening on the dorsal aspect of both hocks, and the distal intertarsal joints are ankylosed. The talus of the left hock is also involved in the arthritic reaction, having exostosis medially around the proximal intertarsal joint(r) and at the distal ends of the trochlear ridges(r).

T talus M metatarsal 3.

Fig 6.

This is a view of the plantar aspect of the joints shown in fig. 5. The left hock is on the left, and the right hock on the right. The medial exostoses(E) can be seen to involve the head of the second metatarsal bone(X) as well as the third(M), on both hocks. The fused first and second tarsals(1) are also involved. The fourth tarsal(4) has exostoses, particularly on the left hock. The reaction(r) on the left talus shown on fig. 5 can be seen from this aspect also.

C calcaneus.


T
E
M
r
T
r
E
M


C
r
4
1
E
M
X
T
C
4
1
E
X
M

Fig. 6B.

This shows the sectioned left (above) and right (below) fused central and third tarsals and metatarsus of horse no. 3. These bones were sectioned from immediately dorsal to the exostosis, directly towards the plantar aspect.

LEFT. The central and third tarsals are fused along 50-60% of the distal intertarsal joint, a remnant of this joint space (J) is visible dorsally. The tarso-metatarsal joint (T) is present along nearly all of its length, but the third tarsal and metatarsus are inseparable, even on the lateral section of the bones, where the exostosis does not hold them together. A line can be seen where the exostosis (E) has grown over the edge of the third tarsal.

RIGHT. The central and third tarsals are fused over about 25% of the length of the distal intertarsal joint, and remnants of joint space (J) are visible near the dorsal and plantar aspects of the joint. The tarso-metatarsal joint (T) is discernible along its whole length. On the lateral section, this joint was not fused, and separated readily.


J
T
E


J

Fig. 6C.

This shows the sectioned central and third tarsals of horse no. 4 . These fused bones were sectioned from the dorsomedial edge, where some joint space was visible, to the plantar aspect.

Just inside the joint margin, a small cavity (L) can be seen. The joint space is visible as a very fine dark line running through the bones, and is largely ankylosed. There is a small cavity (A) in the non-articular area, which is connected with a foramen immediately plantar to it.


L
A

Observations made during surgery

Fibrous tissue increase, to a mild degree, was noted in a horse, during surgery to ankylose the tarsal joints (as described by Adams). This change was in the area of surgical interference, i.e., the dorso-medial area of the hock, at the level of the distal tarsal joints. This horse also had a degree of cunean tendon bursitis. When the bursa was opened, excess fluid was found, also several small free bodies which were about 0.5 cm. in diameter. These were flat and very irregular in shape, and semi-translucent grey-white in colour (Riciform bodies).

A second surgical case had been fired on the left hock about nine months prior to referral and was still lame. The first operation performed on the leg after referral was Wamberg's operation, when a considerable amount of fibrous tissue was found on the fired leg compared to the other leg, which was less severely affected. As this operation proved to be unsuccessful, an arthrodesis operation was performed after a further seven months. At this time, a depth of about 2 cm. of fibrous tissue was present at the site of the firing scar. Beneath this was a large exostosis. (This horse is illustrated in Figs. 19 - 23).

Minor changes found in tarsal bones from clinically normal horses.

The hocks from an 8 year old Arab stallion which had died of colic were macerated after dissection and fusion of the third and second tarsals of one leg was found. The first and second tarsals were fused, as is normal. There was no other abnormality.

Tarsal bones from an eventer, aged 10 years, showed a small cavity in the proximal aspect of the ridge on the medial aspect of the central tarsal, almost at its plantar extremity.

The right hock of a thoroughbred ex-steeplechaser, aged 21 years, showed minor changes. There was some erosion of the compact bone of the distal articular surface of the third tarsal, and the corresponding area of the proximal surface of the third metatarsus. This was on the lateral aspect, extending from the non-articular area. There was roughening of the palmar aspect of central/

central and third tarsals, also first and second (fused) tarsals to a lesser extent. There was a small area of erosion of subchondral bone on the corresponding parts of the articular surface of talus and calcaneus, on the large oval surface.

The tarsal bones of a 6 year old Clydesdale cross thoroughbred hunter (which was destroyed because of lameness in the left hind leg due to severe thoroughpin) were examined. The bones showed roughening around the outside of all tarsal bones, and corresponding areas of roughening of first and third tarsals on the plantar aspect of the joint. This probably indicated fibrous union during life of these two bones in this area.

Radiographically, several types of lesion were identified, and are discussed in the relevant section.

RADIOGRAPHY

Part of this project involved an attempt to find a method for hock radiography, giving consistent results showing the intertarsal and tarso-metatarsal joint spaces clearly and accurately. This was felt to be necessary as it had been noted that positional features could make interpretation of hock radiographs difficult and confusing.

It was hoped that using this scheme for radiography, any alteration indicative of articular disease could be recognised with reasonable certainty, the expected normal appearance of the joints using these views having been established.

A. MATERIALS and METHODS

40 horses were examined radiographically using an X-ray machine mounted on the ceiling of the room on a rail system, giving mobility to the tube[I]. The tube was powered by a three-phase generator capable of an output of 200 kV and 1,000 Ma[2]. The tube had a rotating anode and a focal spot size of 1.2 mm. Accurate centring was made possible by a dark cross projected from the light-beam diaphragm onto the target area. The area irradiated could be altered by adjustment of the light-beam diaphragm.

The same cassette was used for all radiographs to eliminate any error due to differences in cassette or grid. The cassette used was an Ilford grid cassette, size 12 x 10 in. with a grid ratio of 12.1 A small strip was shielded by lead at one end to allow photographic labelling before processing.

I. Siemens 3D suspension system, Siemens, Germany.

2. Triplex Optimatic 1023, Elema-Schonander, Sweden.

The film used was Kodak RP and it was processed by a Williamson automatic film processor. The tube-film distance used was 90 cm. The cassette was held in a mobile adjustable free-standing support.

Of 40 horses examined, 15 were completely sound, 7 lame in sites other than the hock, one had recovered from hock lameness (not tarsal osteoarthritis). 6 were affected by tarsal osteoarthritis, but sound at examination/

examination, 7 were lame tarsal osteoarthritis cases, and 4 were lame as a result of other hock lesions.

1. Beam position

The effect of beam position on the appearance of the joints of the tarsus was investigated, using normal horses as subjects initially.

Various views were used, antero-posterior, lateral-medial, craniolateral-caudomedial oblique, and caudolateral-craniomedial oblique. The height at which the beam was centred was varied also, centring on the various joints as follows:-

Position 1 - proximal intertarsal joint

Position 2 - distal intertarsal joint

Position 3 - tarso-metatarsal joint

The position of these joints was estimated by palpation. The location of the groove at the tarso-metatarsal joint, which is more apparent medially, was taken as the level for position 3. The position of the proximal intertarsal joint was taken to be immediately below the distal ends of the trochlear ridges of the talus, which are palpable. The distance between these anatomical landmarks was halved, to determine the location of the distal intertarsal joint, which could prove very difficult to find by palpation.

Different positions of the limb relative to the beam were used. Positions used are described as e.g., postero-anterior, when the tube position relative to the limb is described by the first word, i.e., in this case, on the plantar aspect of the leg and the film position by the second, i.e., on the dorsal aspect. As implied by the position, the long axis of the limb (i.e., a line from dorsal to plantar aspect) was parallel to the primary beam.

A lateral-medial view was used, and also two obliques. These were a craniolateral-caudomedial oblique at an angle of about 50° to the long axis, and a caudolateral-craniomedial oblique at an angle of 140° to the long axis.

An/

An attempt was made to keep the limb perpendicular to the ground wherever possible. In some cases, when the subject was nervous, sedation was achieved with Acetylpromazine by intravenous injection[1] at standard dose rate. The cassette, held in a free-standing support, was placed in position, then the tube moved into place and the radiograph taken when the horse was immobile.

The hock joints of some of the horses radiographed in this study were later available for dissection and were checked for abnormality. A full series of radiographs were taken of some horses, but only selected views were taken of most, as the animals usually became restless after a time.

1 - ACP injection 10 mg/ml C-Vet.

2. <u>Radiography of horses affected by tarsal osteoarthritis</u>

13 affected horses were used in this study, 4 being radiographed on more than one occasion. This work was conducted concurrently with the series of examinations of normal horses, thus similar views were taken in some instances. In later cases, only those views that appeared to be most appropriate were used. The same equipment was used and as before, if the horse was excessively unsettled, it was sedated.

B. RESULTS

1. Beam Position

It was found that beam position could have a marked effect on the appearance of the joint spaces of a normal tarsus.

At an early stage in the investigation, it was noted that the appearance of the joint spaces on posterio-anterior and lateromedial radiographs was confusing (Figs. 20, 24). This was due to superimposition of the different levels of the curved joint spaces, producing several lines on the radiograph. This feature was less marked on oblique radiographs, and could frequently be eliminated.

The actual oblique views which were taken of the different normal horses and the results in relation to identification of joint spaces are shown in table C. A well angled view of the tarsus from the craniolateral-caudomedial oblique position showed a radiolucent "hole" between the central and third tarsals and fourth tarsal (Fig.10). Radiographs/

Table C.

Giving details of radiographic examinations performed on the hocks of horses with no clinical or radiographic evidence of tarsal osteoarthritis.

Key to symbols used in this table and in table D.

L left hock. R right hock.

CL-CaM O craniolateral-caudomedial oblique.

CaL-CM O caudolateral-craniomedial oblique

PIT proximal intertarsal joint.

DIT distal intertarsal joint.

TMT tarsometatarsal joint.

\+ joint space clearly visible on this view.

\- joint space not clearly visible on this view.

Horse No.	Limb	Joint Space	CL - CaMO view 1	CL - CaMO view 2	CL - CaMO view 3	CaL - CMO view 1	CaL - CMO view 2	CaL - CMO view 3	Comments
34	R.	PIT	+	+	+	-	+	-	View 1 CaL - CMO, dorsal edges of joint spaces poor. Lateral-medial and cranial-caudal also taken. Spaces poor.
		DIT	-	-	+	-	+	-	
		TMT	-	-	+	-	+	+	
35	R.	PIT	+	+	+				Lateral-medial and cranial-caudal views taken. Joint spaces poor.
		DIT	-	+	+				
		TMT	+	-	+				
36	R.	PIT	+	+	+	+	+	+	DIT could only just be seen on view 1 CaL-CMO, and only dorso-medial $\frac{1}{3}$ of space could be seen on CL-CaMO views. This horse was sound in the hind limbs, but may have a partial ankylosis of DIT, as it could not all be seen. CL-CaMO view 3 was repeated, also CaL-CMO views 2 and 3.
		DIT	-	-	-	+	-	-	
		TMT	-	-	+	+	-	-	
37	R.	PIT	+		+				
		DIT	+		+				
		TMT	-		+				
38	L.	PIT			+		+		
		DIT			+		+		
		TMT			+		+		
39	L.	PIT			+				
		DIT			+				
		TMT			+				
	R.	PIT			+				
		DIT			+				
		TMT			+				

40/

Horse No.	Limb	Joint Space	CL - CaMO view			CaL - CMO view			Comments
			1	2	3	1	2	3	
40	L.	PIT		+	+				
		DIT		+	+				
		TMT		-	+				
41	L.	PIT			+				
		DIT			+				
		TMT			+				
	R.	PIT		+	+				
		DIT		-	+				
		TMT		+	+				
42	L.	PIT	+		+				Cranial-caudal view taken
		DIT	-		+				Joint spaces poor.
		TMT	+		+				Pony appeared to have enlargement
	R.	PIT		+	+				at site of spavin. No abnormality
		DIT		+	+				on radiograph.
		TMT		-	+				
43	L.	PIT		+					Joint spaces not visible towards
		DIT		-					plantar aspect.
		TMT		-					
44	L.	PIT	+						
		DIT	+						
		TMT	+						
	R.	PIT	+		+				
		DIT	-		+				
		TMT	-		+				
45	L.	PIT			+				Lateral-medial and cranial-caudal
		DIT			+				views showed joint spaces poorly.
		TMT			+				

46/

Horse No.	Limb	Joint Space	CL - CaMO view			CaL - CMO view			Comments
			1	2	3	1	2	3	
46	L.	PIT			+		+		Pony referred for suspected
		DIT			+		+		"spavin".
		TMT			+		+		Probable hip lameness.
	R.	PIT			+		+		
		DIT			+		+		
		TMT			+		+		
47	L.	PIT		+	+	+			Referred for spavin examination.
		DIT		+	+	+			T1/2 unfused.
		TMT		-	+	+			
	R.	PIT	+		+	+			
		DIT	-		+	+			
		TMT	+		+	+			
48	L.	PIT	+		+		+	+	Enlargement at site of spavin
		DIT	+		+		+	+	on this hock. Ridge on T3
		TMT	+		+		+	-	prominent.
49	L.	PIT	+		+	+			
		DIT	+		+	+			
		TMT	-		+	+			
	R.	PIT		+		+			
		DIT		+		+			
		TMT		+		+			
50	L.	PIT			+		+		Cranial-caudal view demonstrated
		DIT			+		+		exostosis on sustentaculum tali.
		TMT			+		+		

51/

Horse No.	Limb	Joint Space	CL - CaMO view			CaL - CMO view			Comments
			1	2	3	1	2	3	
51	R.	PIT	+		+		+	+	
		DIT	-		+		+	+	
		TMT	-		+		+	-	
52	L.	PIT	+		+		+		
		DIT	-		+		+		
		TMT	+		+		+		
	R.	PIT	+		+			+	
		DIT	-		+			-	
		TMT	-		+			-	
53	L.	PIT		+		+			
		DIT		+		+			
		TMT		-		+			
	R.	PIT			+		+		
		DIT			-		+		
		TMT			+		+		
54	L.	PIT			+				
		DIT			+				
		TMT			+				
	R.	PIT			+				
		DIT			+				
		TMT			+				
55	L.	PIT		+	+		+		Had been retired 5 years previously due to L. hind lameness, thought to be due to spavin. No abnormality of hock found.
		DIT		+	+		+		
		TMT		-	+		+		
	R.	PIT			+	+			
		DIT			+	+			
		TMT			+	+			
56	R.	PIT	+	+	+	+		+	
		DIT	-	-	+	+		-	
		TMT	-	+	+	+		-	

Horse No.	Limb	Joint Space	CL - CaMO view			CaL - CMO view			Comments
			1	2	3	1	2	3	
57	L.	PIT		+	+		+		
		DIT		+	+		+		
		TMT		..	+		+		
	R.	PIT		+			+		
		DIT		+			+		
		TMT		+			+		
58	L.	PIT	+		+	+			
		DIT	+		+	+			
		TMT	-		+	+			
	R.	PIT		+					
		DIT		+					
		TMT		+					
59	R.	PIT	+		+	+		+	
		DIT	+		+	+		-	
		TMT	+		+	+		-	
60	L.	PIT	+	+	+		+		
		DIT	-	-	+		+		
		TMT	-	-	+		+		

Table D.

Giving details of the radiographic examinations performed on horses having definite clinical or radiographic evidence of tarsal osteoarthritis.

The numbers used to identify horses are the same as those in the table of clinical cases.

The key to symbols is as in table C.

Horse No.	Limb	Joint Space	CL - Ca MO View 1	2	3	CaL - CMO View 1	2	3	Comments
7	L.	PIT		+	+		+		L. DIT Ankylosis
		DIT		-	-		-		Examined on 2 occasions
		TMT		+	+		+		- 2 years apart. This refers to 2nd occasion.
	R.	PIT	+						
		DIT	-						
		TMT	-						
16	L.	PIT	+	+	+	+			L. DIT Partial ankylosis
		DIT	-	-	-	-			some views taken of this
		TMT	-	+	+	+			horse were repeated 12, 18 & 21 months later. Examined 4 times.
	R.	PIT	+		+	+			
		DIT	-		-	+			
		TMT	-		+	+			
17	L.	PIT		+	+		+		Radiographs of R. leg -
		DIT		+	+		+		beam position unknown -
		TMT		-	+		+		had been taken on 3 earlier occasions.
	R.	PIT	+	+	+			+	R. - CaL - CMO view 3.
		DIT	-	-	-			-	DIT visible in parts as fine line.
		TMT	+	-	+			+	CL - CaMO DIT visible at dorso-medial edge and on view 3 at plantar edge.
19	L.	PIT			+			+	R.DIT. Ankylosis
		DIT			+			+	+ T1 + 2 unfused
		TMT			+			+	CL - CaMO view 3 and
	R.	PIT	+	+	+			+	CaL - CMO view 3 repeated.
		DIT	-	-	-			-	
		TMT	-	+	+			-	

Horse No.	Limb	Joint Space	CL - Ca MO view			CaL - CMO view			Comments
			1	2	3	1	2	3	
20	L.	PIT	+		+		+		Both legs DIT ankylosis and TMT partial ankylosis.
		DIT	-		-		-		
		TMT	-		-		-		
	R.	PIT		+	+		+		
		DIT		-	-		-		
		TMT		-	-		-		
21	L.	PIT	+		+				
		DIT	-		-				
		TMT	-		+				
	R.	PIT			+				
		DIT			-				
		TMT			+				
24	L.	PIT	-		+	-		-	L. DIT partially visible on CaL - CMO View 1. Repeated. Also partially visible on CL - CaMO view 3. Large exostosis at PIT level.
		DIT	-		-	-		-	
		TMT	+		+	+		+	
	R.	PIT	+	+	+	+		+	R. DIT partially visible on CL - CaMO view 3. Most views repeated at 3 & 8 months later. Examined 3 times.
		DIT	-	-	-	-		-	
		TMT	-	+	+	+		+	
25	L.	PIT	+		+		+		R + L - DIT edge reaction at dorso-medial edge and DIT only just visible at edge.
		DIT	-		+		+		
		TMT	+		+		+		
	R.	PIT		+	+		+		
		DIT		+	+		+		
		TMT		+	+		+		

26/

Horse No.	Limb	Joint Space	CL - Ca MO view			CaL - CMO view			Comments
			1	2	3	1	2	3	
26	L.	PIT	+		+		+		
		DIT	-		-		+		
		TMT	-		+		+		
	R.	PIT		+	+			+	R - DIT very narrow but visible on CL - CaMO view 3. T1/2 unfused.
		DIT		-	+			-	
		TMT		+	+			-	
27	L.	PIT	+		+				L. - DIT visible with lysis in area on CL - CaMO view 3 edge only visible view 1.
		DIT	-		+				
		TMT	+		+				
	R.	PIT			+				
		DIT			+				
		TMT			+				
29	L.	PIT	+		+		+		
		DIT	-		+		+		
		TMT	+		+		+		
	R.	PIT	+		+	-	+		R. - CL-CaMO view 3. Edge of DIT visible. Large exostosis at level of TMT.
		DIT	-		-	-	+		
		TMT	-		-	+	+		
32	L.	PIT	+						Horse was sound - change at dorso-medial edge of DIT. TMT visible as multiple lines.
		DIT	-						
		TMT	-						
33	L.	PIT	+						Horse went lame on spavin test - change at dorso-medial edge of DIT.
		DIT	-						
		TMT	+						

Radiographs showing this feature demonstrated the joint spaces (proximal and distal intertarsal and tarso-metatarsal) more clearly throughout their length than did others(Fig.11).

It was also noted that radiographs taken with the beam positioned at position 3 (tarso-metatarsal joint), generally showed the joint spaces more clearly than with the higher beam position. (Figs. 8, 10) The craniolateral-caudomedial oblique view throws the dorso-medial edge of the hock into profile, which is valuable in cases of tarsal osteoarthritis as lesions are frequently present here.

The best definition of joint spaces was seen on caudolateral-craniomedial oblique views of the hock (Fig. 7). This oblique was found to give a clear view of joint spaces in animals where this was impossible from the other oblique angle. A more clear view was obtained when the beam centre was relatively high, i.e., view 1 or view 2. The appearance of the joint spaces on these views generally was more clear, but agreed with that seen on craniolateral-caudomedial oblique view 3.

Angulation of the limb to the perpendicular could cause loss of clarity of articular spaces, particularly on the caudolateral-craniomedial oblique, this was avoided wherever possible, but in some cases the animal was unwilling to stand with the limb perpendicular and poorer results were obtained.

The caudolateral-craniomedial oblique view showed the third/second tarsal joint and also the first/second tarsal joint when present (Fig.18).

2. <u>Radiography of animals affected by tarsal osteoarthritis</u>

Some of this work was done after it had been established that the craniolateral-caudomedial oblique centred at view 3, and caudolateral-craniomedial oblique, centred at view 1 or 2, were most valuable and these were used the most. Some cases were seen prior to completion of the investigation of the effect of beam position on the radiographic appearance of normal hocks, so views other than those stated above were taken and in a few cases other views were used in an attempt to clarify certain features.

The craniolateral-caudomedial oblique view was found useful in demonstrating lesions at the dorso-medial joint edges, both within/

within the joints, and exostosis around them (Figs. 30,34). The plantar-lateral part of the joint spaces, immediately in front of the fourth tarsal on the radiograph, sometimes appeared to be indefinite, particularly the distal intertarsal joint. In most cases this could be clarified and shown to be present on a caudolateral-craniomedial oblique (Figs. 27,28).

A considerable variation was found in the types of lesions seen radiographically. Most cases which had only recently become lame and thus could be considered to have early lesions, showed a typical appearance. This was characterised by small lytic areas near the dorso-medial margin of the articular space of distal intertarsal and in some cases tarso-metatarsal joints. There was frequently no recognisable exostosis visible in these cases. (Figs. 33,30).

Longstanding cases showed differing degrees of exostosis, some showing none, others a considerable amount (Fig. 32B); this did not seem to be related to severity of lameness. Longstanding cases which had become sound showed variable degrees of ankylosis of distal intertarsal (Figs. 17,18,41) and, in some cases, tarso-metatarsal joints. The affected joint spaces were indistinct and discontinuous, if visible at all. Chronic cases which were still lame showed lack of ankylosis, or as in two cases, a degree of ankylosis but also vague areas of radiolucency and involvement of talus in the arthritic reaction (Figs. 15,20,22,23).

The maturity of the lesion could be estimated by its appearance, as a mature lesion appeared to be generally inactive, with no hazy periarticular reaction and no lytic areas. (Figs.36-38, 17 & 18). An immature lesion frequently showed a vaguely irregular periosteum on the dorso-medial edge of the joints, and lytic areas were evident in this region. (Figs. 33,34,30)

The third/second tarsal joint could be seen on the caudolateral-craniomedial oblique and was apparently normal in most cases, although partial or total loss was seen occasionally. The progression of lesions in two cases, Nos. 7 and 24 (Figs. 33-38, 39-41) are illustrated.

Of/

Of the horses radiographed, one normal, and three affected horses were found to have non-fusion of the first and second tarsals (see anatomy section).

DISCUSSION

In this study, radiographs of the equine tarsus taken by the author and also radiographs present in the files of the University of Glasgow Veterinary School, were examined in an attempt to evaluate the most useful views for diagnostic radiography of tarsal osteoarthritis in the horse. The lesions found were also noted and their development studied in some cases.

Four basic radiographs of the tarsus are usually taken, lateral-medial, dorso-plantar, craniolateral-caudomedial oblique, and caudolateral-craniomedial oblique. By examination of radiographs, it was evident that the dorso-plantar and lateral-medial views were of minimal value for assessment of joint space change in most cases. This was due to superimposition of the lines at different levels of the curved joint spaces, resulting in a confused appearance. The main use of these two views is in diagnosis of hock lesions other than tarsal osteoarthritis.

The craniolateral-caudomedial oblique view of the tarsus was found to be useful in assessment of change in the joint spaces, and on the dorso-medial edge of the tarsus. The most consistently clear view of all the joint spaces was obtained by centring the beam at the level of the tarso-metatarsal joint and the angulation of the limb relative to the beam being such that a radiolucent "hole" appeared dorsal to the fourth tarsal.

In many radiographs, there is an apparent loss or discontinuity of the distal intertarsal joint, this feature may also occur less commonly, in proximal intertarsal joint and tarso-metatarsal joint. In some cases this is due to a genuine partial ankylosis, in others the feature cañ be eliminated by taking another, differently positioned, radiograph. Change was frequently evident at/

at the dorso-medial joint edge, the appearance of which varied slightly with beam height.

The caudolateral-craniomedial oblique view was found to demonstrate proximal and distal intertarsal joints and tarso-metatarsal joint very well, even in cases where this was difficult or impossible using the other oblique view. The first-second and second-third tarsal joints are also evident from this angle. This view was regarded as definitive for assessment of ankylosis of the tarsal joints. The joint edge is of less importance in this case, as the dorso-lateral edge is in profile, where changes are not commonly seen.

The changes seen in tarsal osteoarthritis vary considerably in type, site, and severity. The majority of early cases show lysis of the distal intertarsal and possibly tarso-metatarsal joints, at the dorso-medial edge. There may be varying degrees of periarticular exostosis, which disappear as the lesions progress in some cases, and increase in size in others. As the arthritic reaction progresses, the joints usually begin to ankylose, demonstrated by loss of joint space on radiograph. The lytic lesions may remain to some extent as this process occurs. In some cases, the lysis is extensive, in others, it is not evident at all, and joint space loss is the only change evident.

Involvement of talus, calcaneus, or the lateral side of the joint is rare. It is possible for a large exostosis to be present without extensive articular changes, or for total ankylosis of central and third tarsals to be present with no periarticular reaction.

Thus, radiography is considered to be an essential aid in the diagnosis of tarsal osteoarthritis, and at least the two oblique views should be taken for assessment of the case. These will possibly require repeating at slightly different positions to check the appearance of lesions.

Abbreviations Used In This Section.

PIT	Proximal Intertarsal Joint.
DIT	Distal Intertarsal Joint
TMT	Tarso-Metatarsal Joint
T1	First Tarsal
T2	Second Tarsal
T3	Third Tarsal
TC	Central Tarsal
CM	Craniomedial
CaM	Caudomedial
CL	Craniolateral
CaL	Caudolateral
O	Oblique

NORMAL RADIOGRAPHIC APPEARANCE OF THE EQUINE HOCK AND THE EFFECT UPON THIS OF VARYING BEAM POSITION.

Fig. 7.

Normal 10 year old Anglo-Arab horse, 16.2h.h. This is a CaL-CM O of the right hock, centred at DIT.

Joint spaces are clearly visible, PIT, DIT, TMT, and T3-T2 joint. The second metatarsal is in profile on the plantar aspect.

Fig 8.

This shows the same normal horse as fig 7. The view is a CL-CaM O, centred at the level of PIT. This joint can be seen clearly, as a straight dark line. The appearance of DIT and TMT is confusing, the joint lines appearing discontinuous or multiple. The dorso-medial joint edge is visible in profile, and is normal. The ridge on T3 is not very clear on this photograph.

The "hole" dorsal to fourth tarsal is evident, showing that this radiograph is optimally angled.

Fig. 9.

This is the same animal as in figs. 7 and 8. This view is a CL-CaM O, centred at DIT.

PIT is clerly visible. DIT and TMT are visible along most of their length, but extra lines are present, confusing the appearance of these joints.

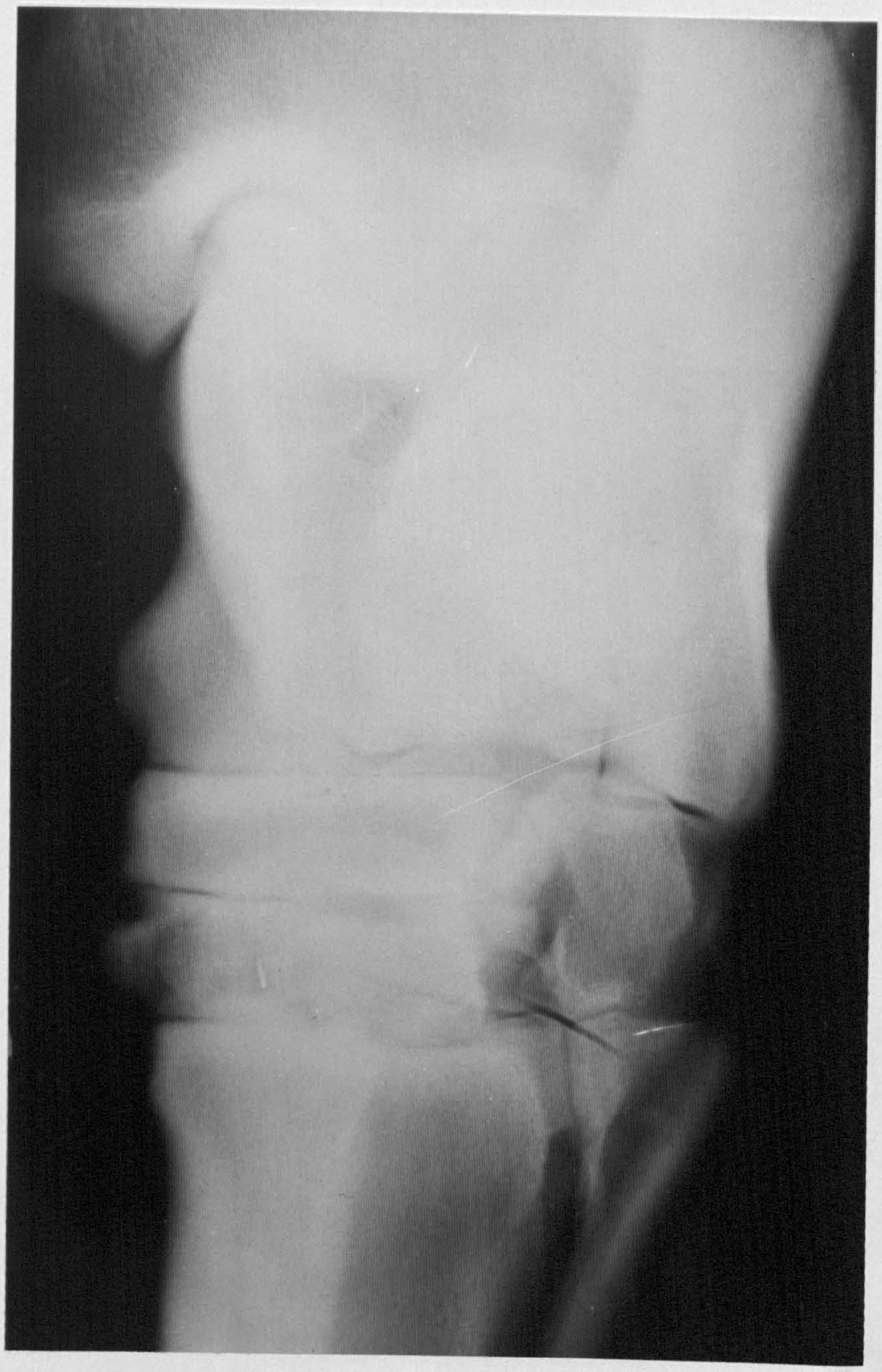


Fig. 10.

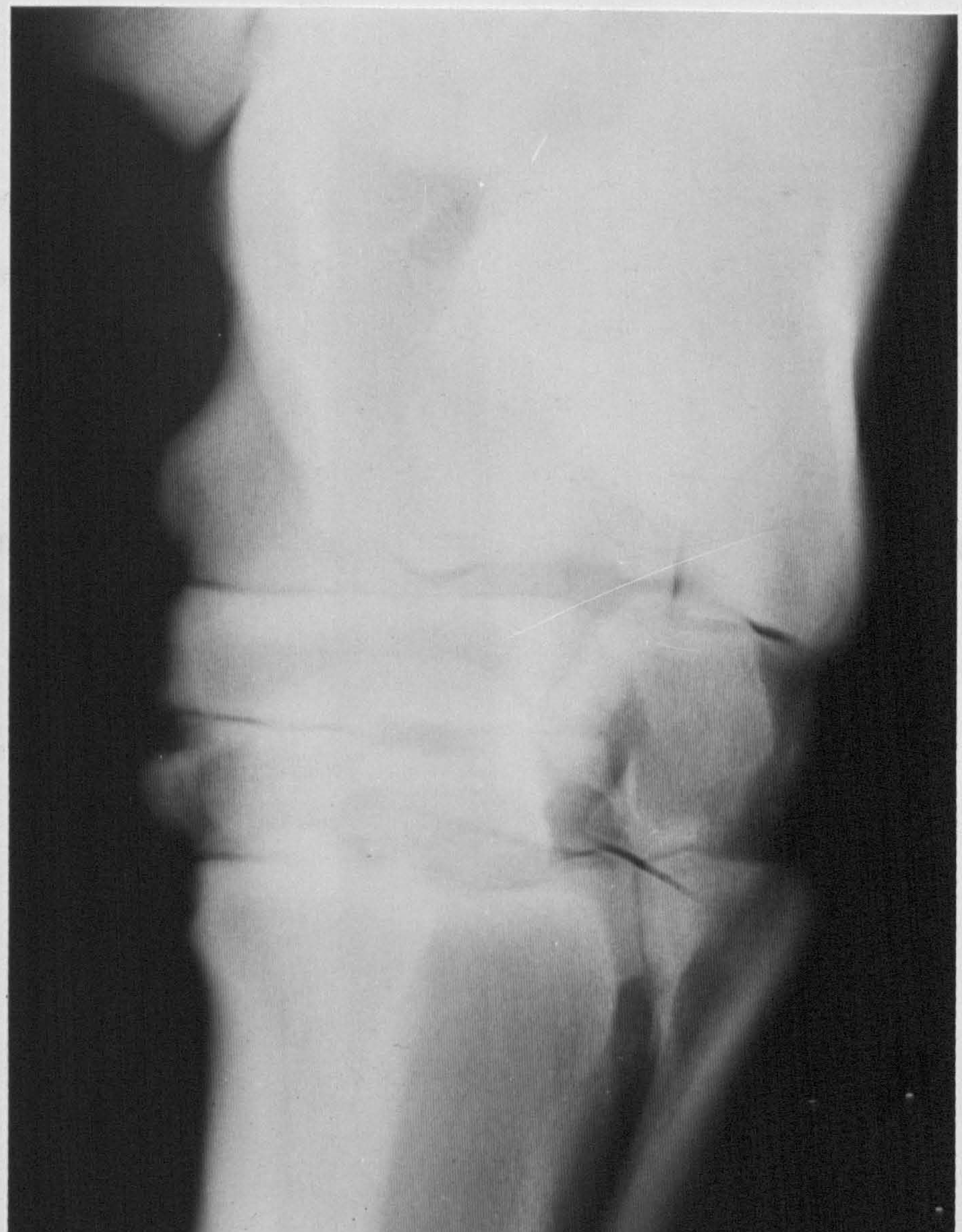
This shows the same horse as figs. 7-9.

This radiograph is a CL-CaM 0, centred at the level of TMT. The "hole" is visible, meaning that the animal is well positioned in relation to the beam direction. All joints can be seen clearly along their whole length, PIT being slightly narrower than DIT and TMT.

Fig. 11.

Showing the same hock as figs. 7-10. This is a CL-CaM O centred at TMT. The limb is not as well positioned as in fig. 10, the "hole" is only just visible, and was not evident on the original radiograph. The DIT and TMT are scarcely visible due to poor positioning. TMT can be seen as a faint line, but DIT is apparently obliterated along most of its length.

This demonstrates the importance of taking at least two radiographs of a joint, as this animal appears abnormal on this view, but no others.



RELATIONSHIP OF RADIOGRAPHIC APPEARANCE TO PATHOLOGY FOUND AT POST-MORTEM EXAMINATION.

These illustrations are of macerated bones of horse no. 1 (pathology section).

Fig 12.

The bones shown are the distal surface of talus(T) and the proximal surface of fourth tarsal(4) of the left hock.

There is extensive cavitation(c) of the dorsal and medial aspects of the talus, and some roughening of the distal ends of the trochlear ridges. There is a marked synovial fossa between the trochlear ridges of both tali, which cannot be seen. The fourth tarsal shows cavitation(c), and also exostosis at the articular margins.

Fig 13.

This shows (left) the proximal aspect of the fused central, third and second tarsals, and the separate first tarsal, of the left hock. There is cavitation(c) on the articular surface of central tarsal opposing talus. The anterior aspect of these fused bones shows very rough exostosis(e) and some cavitation. There is also an area of cavitation on the plantar aspect of the articular surface of central tarsal(c).

The right hand side of the photograph shows the fused central(C) and third(3) tarsals of this horse, and the separate first(1) and second(2) tarsals. There was very little exostosis around this ankylosed joint. Fine lines of new bone could be seen dorsally, apparently corresponding to ossification along the lines of ligamentous attachment(O). A remnant of joint space could be seen at the medial edge(J).


T
c
c
4

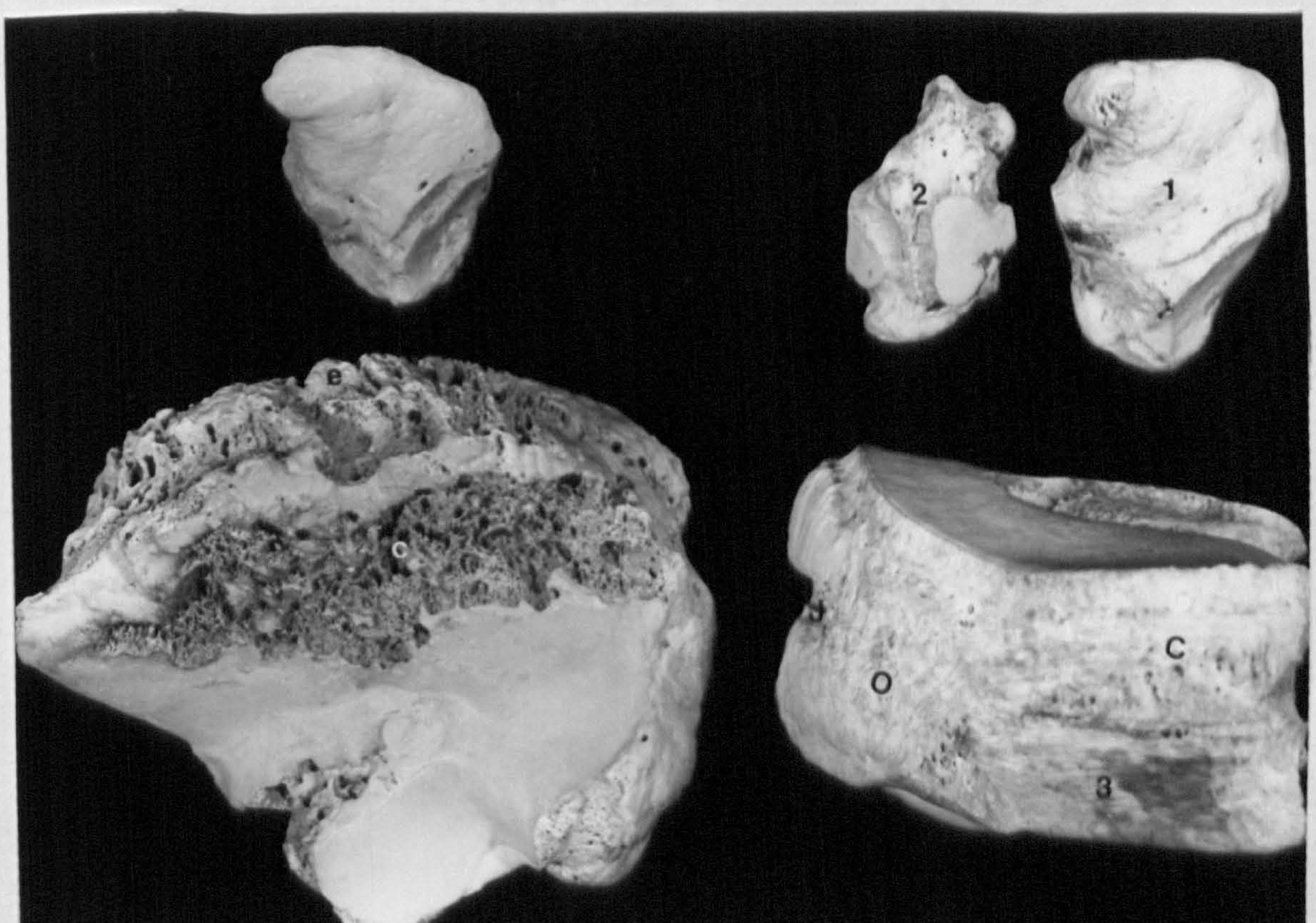
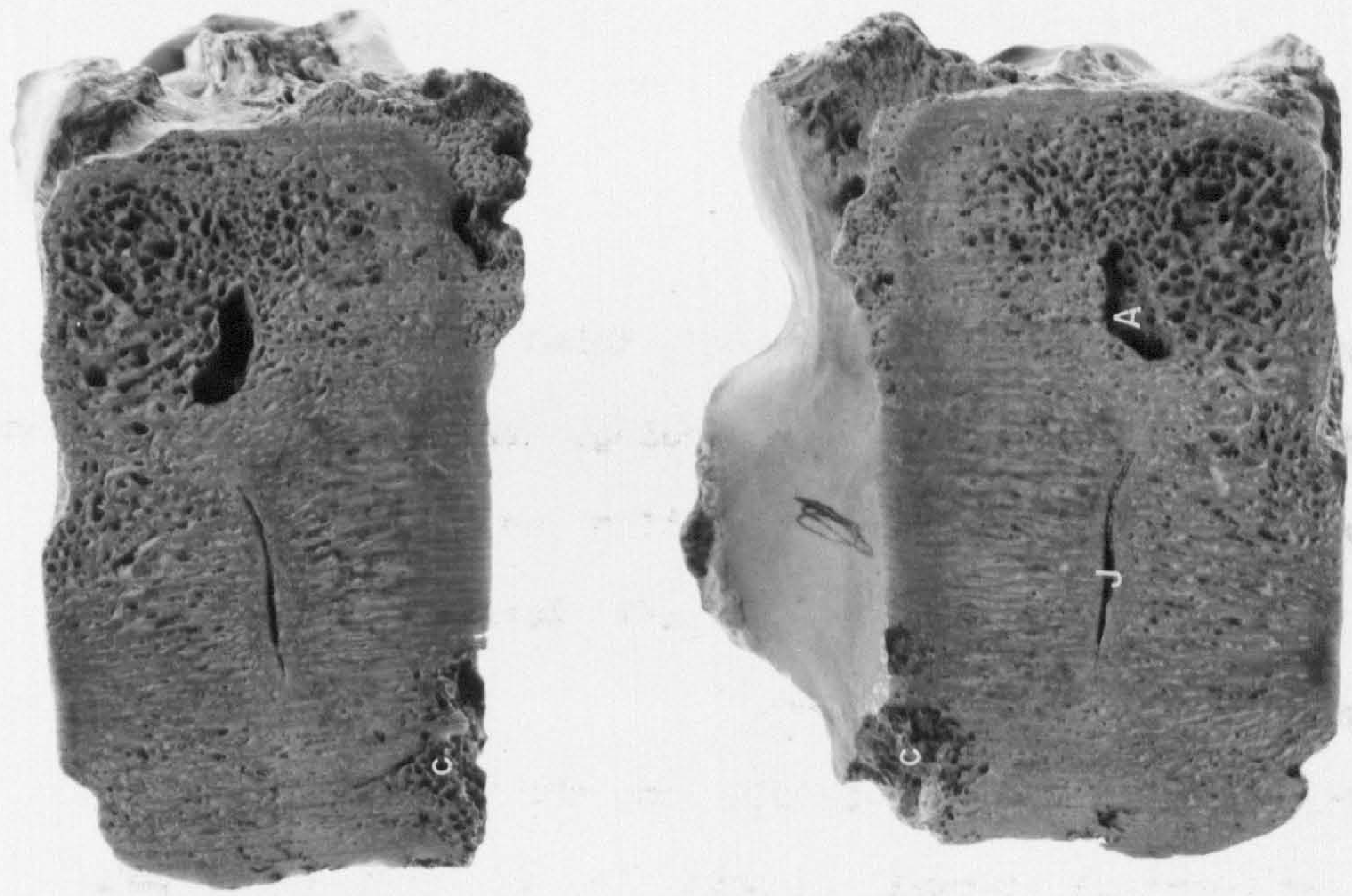

2
1
C
O
C
3

Fig. 13B.

This shows the fused central and third tarsals, sectioned by band-saw, of horse no. 1 (pathology section). These bones were sectioned in the same direction as those in figs. 6C and 16B. The bones of the left tarsus are shown above and those of the right below.

LEFT. The cavitation (c) visible on the proximal articular surface of central tarsal extends to a depth of 3-4mm. The distal intertarsal joint joint is solidly ankylosed at the dorsomedial and lateroplantar edges, only about 25% of thejoint space(J) being visible in the centre of the articulation. A cavity (A) is visible in the area which is non-articular in the normal animal.

RIGHT. There is a remnant of distal intertarsal joint space (J) extending from the dorsomedial aspect, across about 40% of the bones. The posterölateral part of the joint is fused. There is a cavity (A) in the centre of the fused bones, communicating with a foramen on the plantar aspect of the bones, at the level of the articular edge.


c
A
J
c

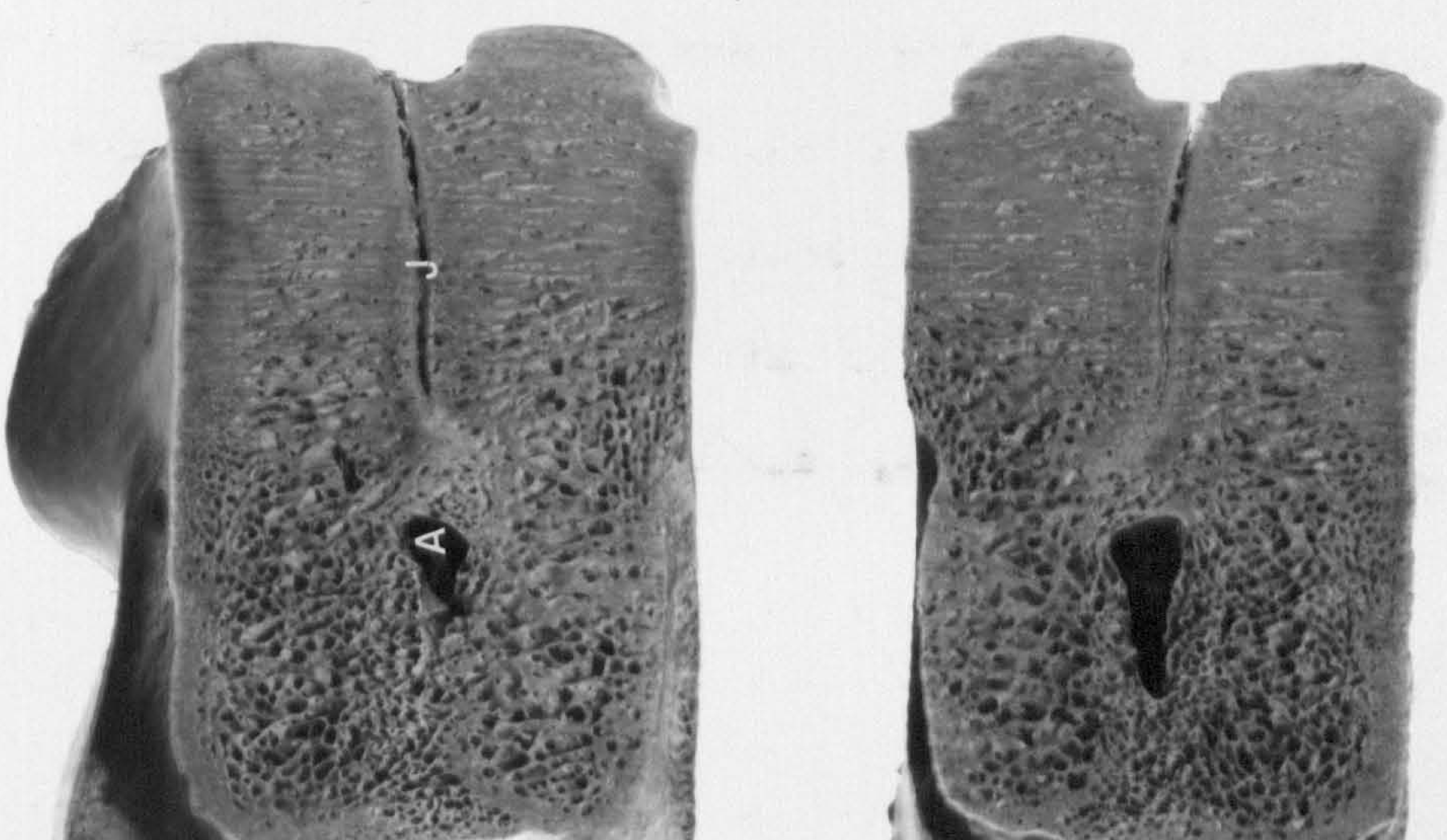

J
A

Fig. 14.

This radiograph, and the following one, are of the hocks of a 9 year old Thoroughbred gelding, used as a show-jumper and eventer (Horse no. 1, pathology). The macerated bones of this horse are shown in figs. 12 and 13. The horse had been lame for a considerable period of time before being sent to the Veterinary School for destruction. These radiographs were taken at this time. He was markedly lame in the left hind leg, and the gluteal muscles on this side were atrophied. The spavin test was positive on this leg. The tarsus was enlarged medially, anteriorly, and laterally. There was no apparent abnormality in the right leg.

This fig. shows the right leg, and the view is a CL-CaM O. The PIT and TMT are clearly visible, but DIT is not apparent, except at the dorso-medial edge. This ankylosis is confirmed by the appearance of the macerated bones in figs. 12 and 13.

Fig. 15.

The same horse is shown as in figs. 12-14. This is a CL-CaM O of the left hock.

Extensive lysis can be seen dorso-medially in the poorly-visible PIT and the anterior aspect of TC and T3. The PIT is not clear, and was probably ankylosed over a large part of its surface by fibrous tissue during life. The DIT is not visible, except for a suggestion of the space dorsally, and was found , on examination of the bones, not to be present. The lytic areas visible on these ankylosed bones can be seen on the dorsal aspect, on this radiograph. The TMT is visible, and appeared normal after maceration.

Fig 16.

This shows the fused central(C), third(3) and second(2) tarsals of horse no. 2 (pathology section). The separate first tarsal is also shown (1).

The bones are shown from the medial aspect, and a remnant of joint space of distal intertarsal joint can be seen (J). Ossified spicules of ligament cross this space. The lateral and dorsal edges of the joint space are totally obliterated. There is very little exostosis, that which is present merely fills the groove at the joint edge, and appears to be mainly along the line of ligaments. The proximal articular surface of central tarsal(P) and distal articular surface of third tarsal, are normal.


P
c
J
2
3
1

Fig. 16B.

This photograph shows the fused central and third tarsals of horse no.2 (pathology section). These bones were sectioned by band-saw along a straight line, approximately from J through P, to the 'notch' visible above P on Fig. 16. The sectioning demonstrates that the central and third tarsal bones are fused along 50-60% of their articular surfaces along this plane. A remnant of joint space (J) runs in from the dorso-medial edge. On the upper section a second line is visible below this, which is an artefact created by the saw. A non-fused area (A) is evident, as in previous illustrations of sectioned fused bones.

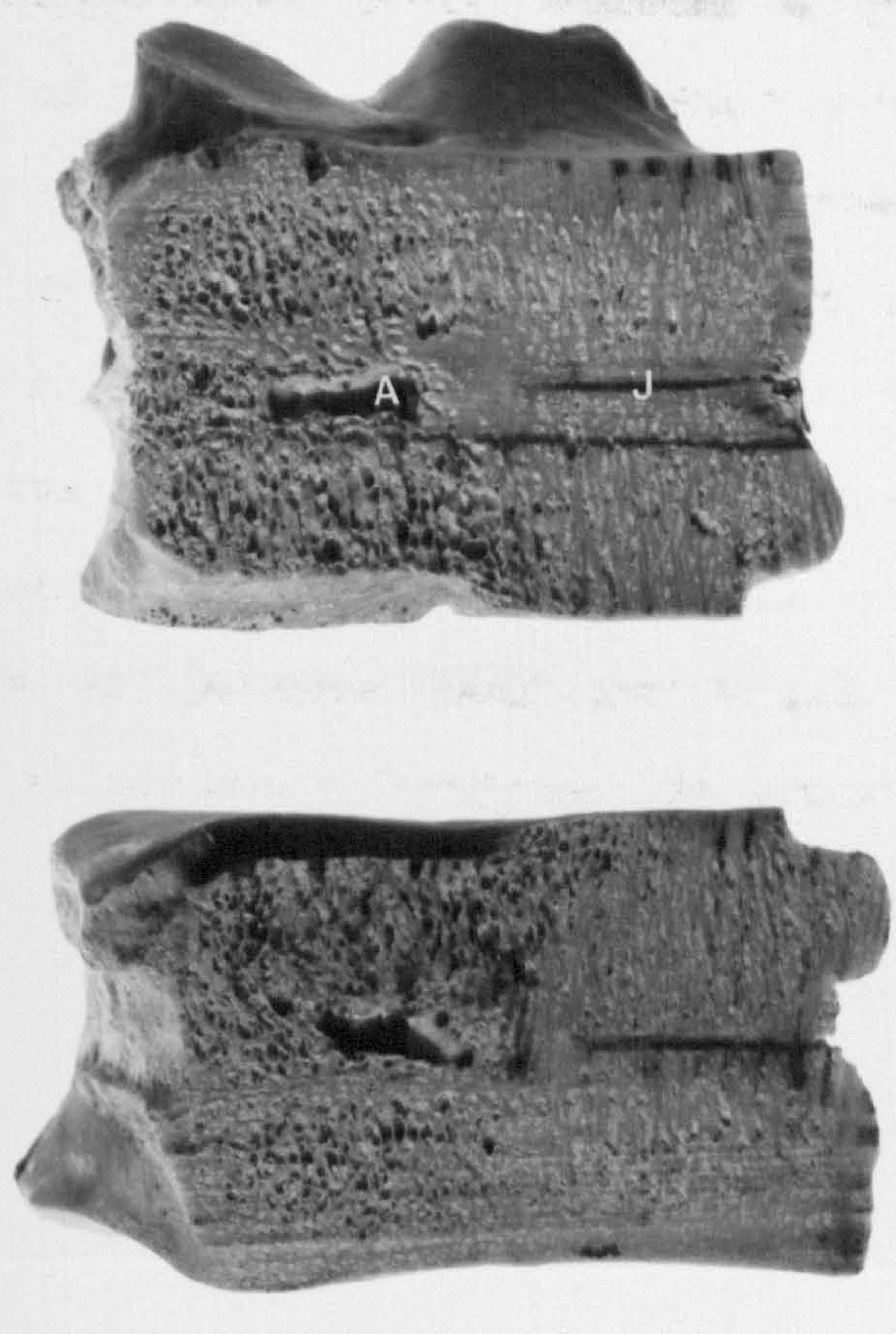

A
J

Fig. 17.

This is a CL-CaM O view of the right hock of the pony whose tarsal bones are illustrated in fig. 16. This radiograph was centered at TMT.

The mare was sound, and did not respond to the spavin test. There was no external enlargement of the hock. When initially radiographed, the animal was expected to be normal.

On this radiograph, the PIT and TMT are visible, but DIT is not. This view was repeated at other beam heights, but no change in this appearance was seen. The DIT was thus presumed to be ankylosed, and was found to be so at post-mortem (fig. 16).

Fig. 18.

This is a radiograph of the same hock as shown in figs. 16 and 17. It is a CaL-CM O of the right tarsus.

The PIT is just visible, as a faint line. It can be seen from fig. 16 that this joint was normal. The DIT is invisible, and is obviously obliterated in fig 16. The TMT is visible as a faint line, but again is seen to be normal in fig. 16. The T3-T2 joint is present, as is the T2-T1 joint. T1 and T2 were completely separate in this animal.

EFFECT OF POSITION OF BEAM ON RADIOGRAPHIC APPEARANCE OF CASES OF TARSAL OSTEOARTHRITIS.

Fig. 19.

This photograph shows the hind limbs of horse no. 24 in the clinical survey table. The animal is a 9 year old pony. The left hind was fired about 6 months before this photograph was taken, resulting in the hairless area visible. The exostosis is clearly visible relatively high on the left tarsus. The right hock shows no noticeable enlargement. The following figures show radiographs of this animal.

Fig. 20.

This is a slightly oblique radiograph, in the CL-CaM direction, of the left hock of the pony shown in fig. 19. The beam was centred at DIT. The pony had been lame for about two years at the time this radiograph was taken. This leg had been fired about 12 months after he became lame, and as there was no improvement, a bilateral Wamberg's operation was performed at Glasgow University Veterinary School 6 months after this. There was then an improvement in the lameness, but about 4 months later, when this radiograph was taken, the lameness became worse again. Three months after this, it was decided to attempt arthrodesis of both hocks of this pony.

The PIT shows irregular lysis, and also a large exostosis medially. The DIT shows irregularity at the medial edge, and is apparently not present laterally. The TMT is just visible. The distal two joint spaces are not well demonstrated.

Fig. 21.

The same animal is shown as in figs. 19 and 20. This is a CL-CaM O of the left hock, centred at PIT. It was taken at the same time as the other radiographs of this horse.

The PIT can again be seen to have lytic areas around it, these are shown to extend along the length of the joint space. The DIT is partly visible, but very indistinct, indicating reactivity and partial ankylosis. TMT is clearer than in fig. 20.

Fig. 22.

This radiograph is of the animal in figs. 19-21, and is a CaL-CM O of the left hock, centred at PIT.

The PIT is largely obliterated, and there is a lytic area dorsally. The DIT is visible along most of its length but is discontinuous over a short length. The TMT is shown as a definite line, and is thus probobly normal along most of its length. There is a minor degree of peaking on the distalsurface of central tarsal.

Fig. 23.

This shows the same animal as figs. 19-22, the view is a CL-CaM O of the right hock, centred at TMT.

PIT is clearly visible and normal. DIT is partially ankylosed, and lysis is evident in the dorso-medial margin. There is also a minor degree of lysis of the TMT at this edge. The joint space of TMT is not very clear and this joint may also be incompletely ankylosed.

Fig. 24.

This is a lateral radiograph of the pony shown in figs. 33-38, taken at the same time as fig. 33.

On this view, the joint spaces are not clear, and there are various confusing lines running to them. There is a suspicion that the joint space is altered dorsally, but this is not clearly demonstrated. The alterations in this joint can be more clearly seen in fig. 33.

Fig. 25.

This, and the following 3 figures, are of a lame 8 year old three-quarter bred eventer. This view is a CaL-CM O of the left hock.

The horse had been mildly lame, or stiff, in the left hind limb for about 2 years when this radiograph was taken. The animal had been treated by rest, and at times, work on phenylbutazone powders. There had been no real improvement in the lameness. It was decided to attempt surgical arthrodesis of DIT and TMT joints of this leg at the time of this examination, in view of the lack of alteration in radiographic appearance from previous occassions.

The PIT can be seen clearly throughout its length as a curved line. The DIT is seen as a discontinuous line, as is TMT, indicating loss of joint space due to a small degree of ankylosis. This radiograph was repeated to ensure that this appearance was not merely a positional feature, but the appearance was consistently present.

Fig. 26.

This is a CL-CaM O of the same hock as shown in fig. 25. Some loss of the joint space of DIT can be seen, as was evident in fig. 25. There is no apparent reaction at the joint edge.

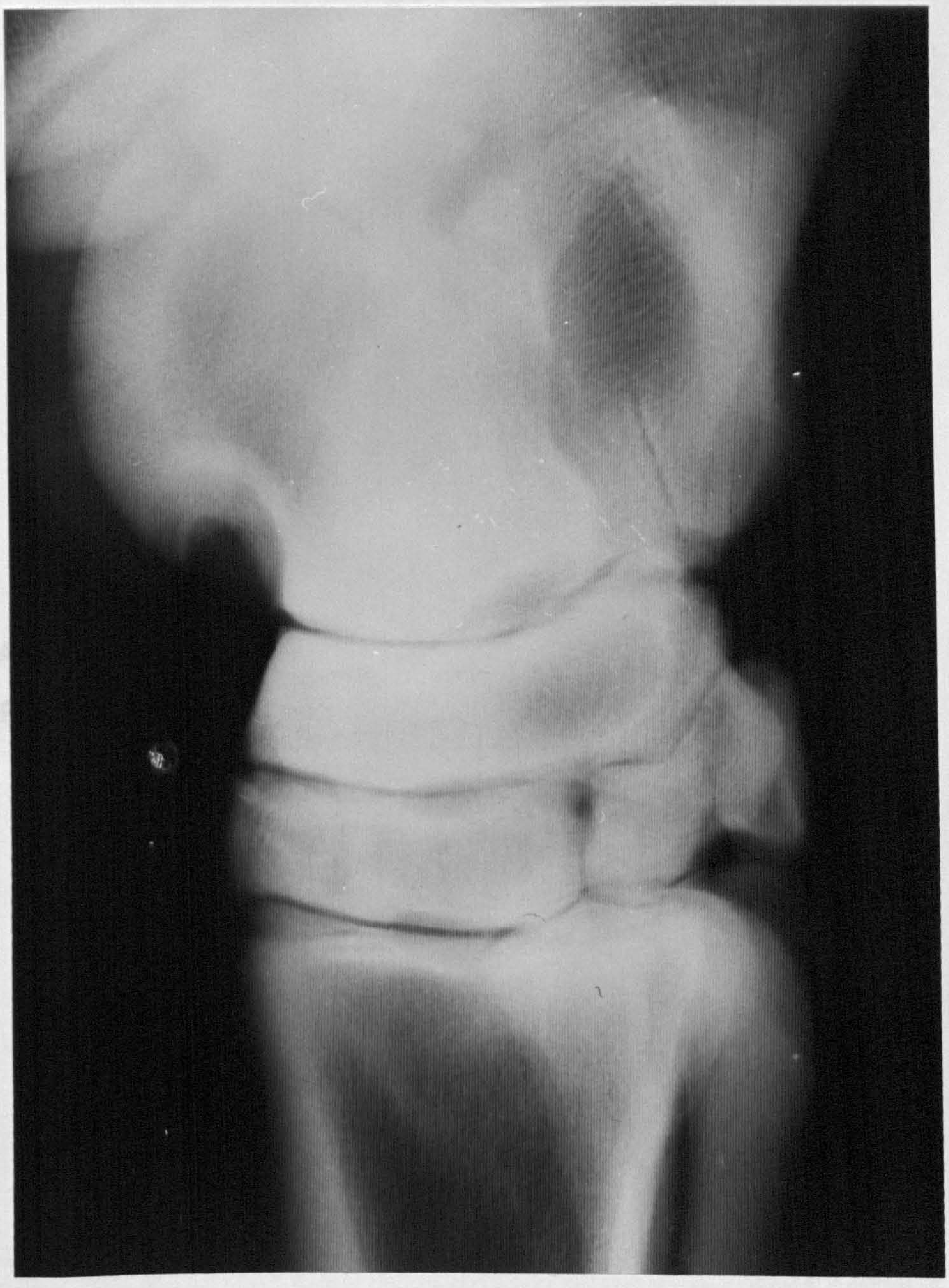
Fig. 27.

This is a CL-CaM O of the right hock of the horse shown in figs. 25 and 26.

The PIT and TMT are clearly visible. There is apparent loss of DIT towards the plantar aspect of this joint, however the animal was not very well positioned, shown by the absence of the "hole" dorsal to fourth tarsal. This joint space is clarified in the next figure.

Fig. 28.

This is of the animal shown in the preceding 3 figures. The view is a CaL-CM 0 of the right hock. On this view, all joint spaces are seen to be clearly present, and the suspicion of ankylosis of DIT in fig. 27 is proved to be false.



RADIOGRAPHIC APPEARANCE OF TWO OF THE MORE COMMON TYPES OF TARSAL OSTEOARTHRITIS.

Fig. 30.

This radiograph is a CL-CaM O of a 6 year old horse bought by the police. Radiographs were taken to check for abnormalities. The animal was not lame, but the spavin test was positive on this leg (the left). The horse had very poor hind limb conformation and action.

Lysis can be seen at the dorso-medial edge of the DITspace, and the space is also not visible at its dorsal part, indicating a probable partial ankylosis. The area appears to be reactive, indicating that the arthritic process is still occurring in this joint.

Fig. 31.

This is an anterior view of the right hock of case no. 29 (clinical survey). The large exostosis at the level of TMT and DIT can be seen. The next two figures are radiographs of this leg.

Fig. 32A.

This is a CL-CaM O radiograph of the right hock of an 8 year old thoroughbred gelding, used as an eventer. He had developed an obvious "spavin exostosis" about 1 year before this radiograph was taken, and as far as is known, had never been lame. The appearance of the limb is shown in fig 31. The horse moved badly, but the toes were not dragged. The PIT appears to be normal. There is considerable exostosis and reaction at the dorso-medial edge of DIT and TMT. The joint space is involved in this area, but appears normal a little further along the space. The joint spaces become invisible again towards their plantar aspect, but in view of their appearance in fig. 32B, this appearance is probably artificial.

Fig 32B.

This radiograph is of the same animal as fig. 32A. It is a CaL-CM O of the right leg.

There is loss of joint space of DIT and TMT. The T3-T2 joint appears to be obliterated. These changes are mainly in the area of the joint edge near the exostosis. Exostosis joins the small and large metatarsals to the tarsus.

RADIOGRAPHS SHOWING PROGRESSION OF CASES OF TARSAL OSTEOARTHRITIS.

Fig. 33.

This is a CL-CaM O radiograph of the right hock of a 12h.h. 9year old gymkhana pony, who was lame in the right hind leg. The pony was treated by rest. The progression of the lesions of tarsal osteoarthritis in this animal is shown in this and the following 5figures.

Early lesions are visible- the DIT shows lysis at the dorso-medial edge, as does the TMT. No periarticular reaction is evident.

Fig. 34.

This is a radiograph of the same hock that in fig.33, but taken 3 months later.

More advanced lysis can be seen at the dorso-medial edge of DIT and TMT. There is a spur at the margin of TMT, extending from T3 to metatarsus; this is more easily seen on the original than on the photograph. The joint spaces appear less clear than previously.

Fig. 35.

Showing the same limb of the same pony as the previous 2 figures. This radiograph was taken 5 months after fig. 34, and the pony was still lame at this time.

The lysis in DIT has increased, and the rest of the joint space is not very clear. TMT shows more extensive lysis at the dorso-medial edge, and there is still a spur present at this joint edge.

Fig. 36.

This is a CL-CaM O of the pony in figs. 33-35. The beam was centred at PIT. This radiograph was taken 13 months after fig. 35.

There is still a small amount of lysis in DIT at the dorso-medial edge, but this joint space lacks clarity, and is present as only a fine line in parts. There is also a relatively minor degree of lysis in TMT at the joint edge, and the joint itself is not clearly visible, suggesting probable partial ankylosis. The degree of reactivity has decreased markedly from the previous radiograph. The spur at the edge of TMT has virtually disappeared.

Fig. 37.

This shows the same pony as figs. 33-36, and was taken on the same date as fig. 36 It is a CaL-CM O of the right hock.

The PIT is visible along nearly all of its length, apparently disappearing at the plantar aspect, but this is probably a positional feature, as all the joints lack clarity in this area. The DIT is a discontinuous line, indicating partial ankylosis, which had occurred by this stage of the disease. The TMT is a normal clear line, except at the dorso-lateral edge, where a degree of peaking could be seen on the radiograph. This is the remnant of the reactive area previously visible in this joint.

Fig. 38.

This is a CL-CaM O of the right hock of the pony shown in figs. 33-37, centred at the DIT. It was taken at the same time as figs. 36 and 37.

Lysis can be seen at the edges of DIT and TMT. A leeser degree is present than in previous radiographs, and spur formation has decreased. DIT and TMT joints are not very clearly visible, indicating partial ankylosis.

Fig. 39.

This is a radiograph of the left hock of a 5 year old 12.2h.h. Welsh show pony mare. The view is a CL-CaM O. The mare was lame in this leg, and had been lame for several months. The spavin test was markedly positive.

The PIT is apparently normal. DIT shows lysis at its dorso-medial edge, is irregular, and appears to be ankylosed in some parts. TMT is normal.

Fig. 40

This shows the same view of the same hock as the previous figure, but it was taken 2 years later. The pony was sound at this time, and no external enlargement was visible. The DITis visible on the plantar aspect and at the dorsal edge, where there is apparently some remaining abnormality. This joint is ankylosed over most of its length. TMT is apparently normal.

Fig. 41.

This is a CaL-CM O of the left hock of the same pony as figs. 39 and 40. It was taken on the same day as fig. 40.

The DIT is not visible, indicating that there is a high degree of ankylosis in this joint. The TMT can be seen as an almost continuous line; this joint is possibly partially ankylosed. There was a minor degree of peaking on the edge of T3 on the original radiograph.

DISCUSSION

I. CLINICAL and RADIOGRAPHIC FEATURES OF TARSAL OSTEOARTHRITIS

The clinical features noted were of a similar nature to those described by the majority of authors. The relatively small number of animals with a noticeable enlargement at the "site of spavin" is the only unusual finding. These animals could be described as having "occult spavin", as this is described as spavin without external enlargement. This condition is generally considered to have a poor prognosis, and as is demonstrated in the table showing clinical material, this is not generally true in these cases. Thus, it would seem logical to consider all cases as various degrees of tarsal osteoarthritis, and ascertain the prognosis on other criteria.

The age at which this disease generally becomes manifest is 5 to 7 years and few cases occur after 10 years of age. It is thus a disease of the younger horse, appearing during the time of hardest work. This, coupled with the fact that many animals have defects in conformation and action, suggests that one of the main aetiological factors is probably abnormal stresses produced by these defects.

Diagnosis of tarsal osteoarthritis may be difficult in the absence of any external enlargement. Even if an enlargement is present, this may not be causing the lameness. The spavin test can be a useful aid to diagnosis. However, the response to this test cannot be taken as a definite indication that the animal is, or is not, affected by tarsal osteoarthritis, as other conditions producing pain in the hock, stifle or hip can give a positive reaction. A negative reaction may be given by an animal with an ankylosed tarsus. Palpation of the lower tarsal area may enable swelling or pain to be located but this is not a constant feature. In cases where tarsal osteoarthritis is suspected, both hind limbs should be carefully examined for evidence of abnormality, as both hocks are frequently affected.

Radiography is the only means of establishing a definite diagnosis/

diagnosis in some cases of tarsal osteoarthritis. In all cases, some degree of change can be seen if appropriate views are taken. The views outlined in the radiography section of this dissertation proved to be very useful in demonstrating abnormality in clinical cases showing change in varying sites in the tarsus.

Radiography is helpful in assessment of the prognosis of cases, as the degree of maturity of the lesion can be estimated, and the exact site seen. Knowledge of the site is of value, as the prognosis of cases where the talus or calcaneus is involved is poor. Cases where only central, third and possibly second tarsals and their articulations are involved, generally have a fairly good prognosis. If dorsal or lateral edges of the joint are involved, then the prognosis is less favourable and the likelihood of recovery low. As both limbs are commonly affected, if tarsal osteoarthritis is diagnosed in one limb, the other should also be radiographed.

If radiographic technique is adequate, lesions can be found in any animal lame due to tarsal osteoarthritis. This finding opposes that of Wamberg (1955), who claimed that, of 15 horses believed to have 'spavin', only 3 had radiographically demonstrable changes. In view of this observation, it is possible that the techniques used for radiography were inferior to those currently in use, thus not revealing minor changes. It is also possible that these horses, which were mainly standardbred trotters, were affected by 'spavin' as described by Lutz and Gabel (1969) who reported cunean tendon bursitis as a common cause of 'spavin' signs in this breed. Differentiation of the two conditions could be achieved by injection of local anaesthetic into the cunean bursa.

The breed and type of work performed by the animal do not seem to be of importance in the development of tarsal osteoarthritis, in the cases included in this study. It is possible that the lower incidence in show animals is due to the good conformation essential for this type of animal.

The progression of lesions has been followed fairly closely in one animal, and to a lesser extent in several others. From this limited/

limited material, the initial reaction appears radiographically as a lytic area, usually on the dorso-medial side of the hock, in many cases. This may be accompanied by varying degrees of exostosis. The reaction then moves along the joint space, and gradually progresses towards ankylosis as new bone is laid down. Exostosis may increase or decrease in extent. Eventually a degree of ankylosis is attained, the joint spaces lose their reactive appearance, and are partially obscured on radiography. The animal becomes sound, or nearly so, in many cases when this stage has been reached. There are many variations on this progression; in some cases there is little involvement of the joint space and the reaction is mainly peri-articular; in others, lysis increases, and ankylosis is delayed or does not occur - these cases do not become sound.

II PATHOLOGICAL and ANATOMICAL FEATURES

In the tarsus, some features are frequently seen which could be considered pathological. As suggested by Wamberg (1953), it is common to find small lines and other defects on the articular surfaces of the flat bones of the tarsus in a horse that was apparently normal. The clinical significance of these lines appears to be nil, thus they could be considered a physiological feature, caused by wear, rather than a pathological one.

Pathological features appear to be loss of compact bone underlying the articular surfaces, roughening and exostosis on the articular margins and non-articular surfaces of the bones, and partial ankylosis of articulating bones. Other changes include thickening of ligaments, ossification at their attachments, and cunean bursitis in some cases. Frequently, much of the apparent exostosis proves, when radiographed or explored, to consist of thick fibrous tissue. Lameness appears to cease when the inflammatory reaction in the area decreases and partial ankylosis occurs.

Arthritic changes usually begin in the central-third tarsal articulation, and may also affect the third-second tarsal joint. In/

In some cases the changes later affect the tarso-metatarsal joint. The changes are frequently confined to the dorso-medial part of the joint space and the bone edges in that area. This type of lesion had a good prognosis. In cases where the talus also becomes involved, ankylosis is unlikely to occur, and the subchondral bone becomes porotic, possibly even forming large cavitations. The prognosis in these cases is poor.

From the rather limited amount of material examined, it seems that first-second tarsal union or non-union may be related in some way to the development of tarsal osteoarthritis. Of the four specimens of affected bones available for maceration during the period of this study, two had un-united first and second tarsals, and a further two cases revealed this on radiography. Unfortunately, not all the horses seen were radiographed from the angle demonstrating this joint space. None of the normal bones macerated had separate first and second tarsals and only one normal horse showed this feature radiographically. Thus, it appears possible that there is perhaps a higher incidence of tarsal osteoarthritis in horses with separate first and second tarsals, than in those with the more usual pattern of fused first and second tarsals.

Exostosis occurs mainly on the medial side of the tarsus in tarsal osteoarthritis. Affected animals are frequently cow hocked or sickle hocked; this type of conformation could be visualised as producing excessive strain on the medial aspect of the tarsus, resulting in tearing of ligaments and periosteum in the area and consequent exostosis. This cannot be regarded as the pathogenesis of all cases of tarsal osteoarthritis, as no exostosis is found in a significant number of cases.

It is interesting to note, that in the macerated specimens included in this study showing intra-articular ankylosis but no marked exostosis, there was consistently a small remnant of joint edge visible on the medial aspect of the fused central and third tarsal bones. This is a surprising feature, as this area is the prime site of exostosis in many cases. In dissections it was found that there is a small area, over the medial aspect of the distal/

distal intertarsal joint, where ligaments are not attached close to the articulation. It is possible that the joint edge remains here as there are no ligamentous attachments to produce periosteal damage.

In cases where there is more extensive ligament tearing the exuberant new bone formation overgrows this area. This theory could be supported by the fact that, radiographically, in some cases, a radiolucent area may be seen at this approximate position, apparently within the exostosis.

III. SURGICAL PROCEDURES

The surgical procedures currently in use for this condition are:-

1. Firing
2. Cunean Tenotomy
3. Peter-Schmidt operation
4. Wamberg's operation
5. Arthrodesis

The principle behind the use of firing is the induction of an inflammatory response in the affected area, in an attempt to set up a reparative process. The only case seen here that had been fired had about 2 cm of fibrous tissue reaction at the site and was no more sound that before treatment. It would seem doubtful that firing is of any value, as the most clinically important lesions of this disease are inaccessible, being within the very narrow joint spaces. Firing appears principally to stimulate fibrosis, which is of no benefit; in addition, it may interfere with subsequent surgical procedures.

Cunean tenotomy was introduced in the hope of removing pain caused by pressure on the area of reaction and exostosis by the cunean tendon and its bursa, which may also be inflamed. The Peter-Schmidt, and later the Wamberg operation are modifications of this technique. Cunean tenotomy is of some value in cases where the lameness is due to pressure in the area. The Wamberg operation aims to remove pressure and also, by means of a diamond-shaped incision through the ligaments and periosteum in the area, to sever peripheral/

peripheral nerve branches running to the "site of spavin". Wamberg considered that the lameness in cases of tarsal osteoarthritis was caused by inflammation and pain in the tissues medial to the gliding articulations of the tarsus. Thus, by performing a peripheral neurectomy, he stopped this pain. It has been suggested that the nerve fibres probably re-grow fairly quickly, and this would seem to be possible. One case operated on at Glasgow University Veterinary Hospital improved for several months post-operatively, although never sound, but then it became even more lame.

The Peter-Schmidt technique has not been used on any of the animals included in this study. In this technique, a cunean tenotomy is performed, and the cut extended deeply into the ligaments and periosteum beneath the tendon. Various modifications exist, where two or three cuts are made at an angle to each other. The aim is to stimulate ankylosis. Surgeons who use this operation claim reasonable success with it.

Adams' arthrodesis operation has the most scientifically valid basis; it aims to produce ankylosis, which appears to be the natural endpoint of most cases of tarsal osteoarthritis. The joint surfaces themselves are attacked, as had been previously suggested by Smith (1893), thus ankylosis must be stimulated by this operation. This operation has been used on several cases here, two of which had previously been treated unsuccessfully. The progress made by these cases was encouraging in the first two months post-operatively.

All of these techniques have been shown to be effective in a percentage of cases. It is clear, however, that they do not produce the same result in all cases of tarsal osteoarthritis, and that a method of assessment on the basis of clinical and radiographic findings may help in the selection of the technique of choice in a particular case. The following criteria are suggested to enable this to be done:-

1. <u>Conservative treatment</u>

This is suitable in cases in which lesions are not involving areas/

areas other than the distal intertarsal and tarso-metatarsal joint spaces, and periarticular change is confined to the dorso-medial aspect of the joint. This treatment has a reasonable chance of success if ankylosis appears to be occurring without surgical interference. No harm can be done by using this treatment as an initial measure in most cases showing the radiographic features described. If, when radiographed again in 3-6 months, no ankylosis is occurring, then surgical means should be tried. The degree of lameness of the animal determines the exact type of treatment. A mildly lame case may be worked lightly on anti-inflammatory/analgesic agents. A more severely lame animal should be turned out and rested.

2. Wamberg's operation

This procedure is of use when there is pain from lesions on the dorso-medial area of the joint and its surrounding structures. This is a feature in some animals where there are small lytic areas in the dorso-medial part of the joint spaces, and periarticular reaction and exostosis in this area. The Wamberg operation relieves pressure on the area, also cunean bursitis, and may sever the nerve supply, at least temporarily. As it does nothing towards promoting ankylosis, it is of little value in cases with extensive articular lesions. Presumably the Peter-Schmidt operation has similar actions, except, possibly, the denervation.

3. Adams' arthrodesis operation

This operation acts to promote ankylosis. It is of value in cases where this process is essential because of extensive articular lesions in the distal intertarsal or tarso-metatarsal joints. It may also be of value in cases where the proximal intertarsal joint is involved, as ankylosis seems unlikely to occur naturally in these cases. This has not been proved in this study, but it is the only treatment likely to help such cases. Long-standing and intractable cases are often animals in which articular lesions are present, and ankylosis is slow, or there are/

are lesions in unusual sites (i.e. laterally, anteriorly, or in the proximal intertarsal joint). Adams' operation is thus suitable for use also in this type of case, in which other treatments may have failed.

Some types of case respond poorly to treatment, these, as mentioned previously, are animals with unusual lesions. If an animal affected in this way is of low value, it may be advisable to destroy or retire it, rather than attempt expensive and unsuccessful treatments.

IV. WAMBERG'S CONCLUSIONS ON SPAVIN

There are several notable differences between the results of this study and those of Wamberg.

Firstly, as discussed earlier, Wamberg did not consider radiographic change to be a constant feature of cases of bone spavin, whereas it was demonstrable in all cases described in this study. This difference could be due to poorer radiograph quality when Wamberg was carrying out this work in the early 1950's, or to the use of inappropriate views, thus failing to demonstrate change. It is also possible that the animals in Wamberg's study had cunean tendon bursitis rather than tarsal osteoarthritis; the majority of Wamberg's cases occurred in trotting horses in which cunean bursitis is common.

Secondly, Wamberg found a very high incidence of abnormality in hock joints from horses sound prior to death. Of 199 joints from 103 horses, only one horse had no abnormality. However, the full history of these horses was not known in most cases and some may have at some time suffered from "spavin" lameness. In this study, many of the bones examined were from animals known to be abnormal. Of the small number examined from animals sound prior to death (16 joints), 7 were found to be abnormal. This is a much lower percentage than that found by Wamberg.

This could be due to the fact that many of Wamberg's specimens were from old animals, as they were from horses destroyed at the slaughter house for various reasons. The specimens used in this study were from animals, mainly under the age of 10-11 years, destroyed at/

at the University of Glasgow Veterinary Hospital. Only two animals were over this age, one 12, one 21 years, both were sound in the hocks clinically but abnormal on examination of the bones (see Pathology section). Unfortunately, in the cases considered sound before death, there was, as in Wamberg's study, no history regarding hock lameness.

Thirdly, Wamberg claimed that the lameness could be totally alleviated by local anaesthetic infiltration of the lower medial tarsal area as described by Berge (1934). This would also seem to indicate that the main condition he was treating was cunean tendon bursitis, as this technique is not very successful in alleviating lameness in cases of tarsal osteoarthritis (Schebitz, 1965; Adams, 1974).

Wamberg's operation produced excellent results, as recorded in his publications; the results obtained during this study, when the operation was performed only on animals with clinical signs and radiographic change, were not as good. (66% success compared to 50% for conservative treatment - in those cases where the outcome was known).

The 16% improvement in success rate over that obtained for conservative treatment could be due to the relief of cunean tendon bursitis in these cases. This condition appears to exist with arthritic changes in some cases and could be the cause of lameness if arthritis is not extensive. The only case in this study that was re-radiographed after a successful Wamberg's operation (done 2 years previously), was found to have developed ankylosis of central and third tarsals. One horse treated successfully by conservative means was found to have a similar degree of ankylosis radiographically. Other successful Wamberg operations were judged on the report of the owner, except in one case where the animal was clinically examined.

Two horses sound prior to death were found to have a high degree of ankylosis of the distal intertarsal joint at post-mortem examination (Figs.16B,C), suggesting that lameness, if present, ceases when the ankylosis is moderately advanced and inflammation decreases./

decreases. A third horse was lame in one hind limb, in which ankylosis of the distal intertarsal joint was fairly advanced, but there was severe cavitation in some areas of the bone, (Figs. 12, 13, 13B) which probably produced the pain. The other tarsus was also ankylosed over most of the articular surface of the distal intertarsal joint, the animal was apparently sound in this limb.

Joints showing tarsal osteoarthritis with ankylosis examined in this study always had a high degree of internal ankylosis. In no case was purely external ankylosis seen.

The pain of "spavin" lameness is not in all cases due, as Wamberg suggests, to a periarthritis medial to the gliding joints of the hock. If this were true, Wamberg's operation or local anaesthesia of this area would relieve all cases. The pain must, in many cases, arise from another area or areas which are not yet defined, but are possibly intra-articular and therefore the pain is likely to be relieved once ankylosis occurs.

SECTION 3

OTHER HOCK

LESIONS

OTHER HOCK LESIONS - A REVIEW

In addition to tarsal osteoarthritis, many other hock lesions occur and have been described in the literature. The following is a brief description of the lesions from some of the relevant literature.

Capped Hock: This is a traumatic subcutaneous calcaneal bursitis. The subcutaneous tissue and bursa between the skin and superficial digital flexor tendon are involved. (Gill 1973) It is caused by trauma to the point of the hock and is characterised by a swelling at the point of injury, which may also be accompanied by a curb (Adams 1974). This condition rarely produces lameness except in the early acute stages. The blemish is usually permanent, but if treated early by the administration of phenylbutazone and cold hosing, may be minimised (Gill 1973). The chronic condition may be treated by paracentesis and intra-bursal injection of corticosteroids (Adams 1974, Gill, 1973, Van Pelt and Riley 1968). Surgical resection of the bursa and surrounding fibrous tissue may be performed but wound breakdown is likely, causing a worse blemish than before (Adams 1974). In some cases a bursitis may arise in the bursa under the gastrocnemius tendon at its insertion at the point of the hock, or in the bursa located between the gastrocnemius and superficial digital flexor tendons. This is the type of injury most likely to be accompanied by curb and is not always easily detected (Van Pelt and Riley, 1968).

Thoroughpin: This is the name given to tenosynovitis of the tarsal sheath of the deep digital flexor tendon of the hind limb. The aetiology is usually trauma (Van Pelt 1969, Adams 1974). It appears as a swelling at the level of the point of the hock, but dorsal to it. The size is variable, and the swelling tends to be more prominent on the medial side. In long standing cases the distension extends laterally, and may even extend distally along the plantar ligament as a "soft curb" (Rooney 1972). Most affected animals are not lame. Treatment consists of rest, cold water application, and phenylbutazone/

phenylbutazone medication in early cases (Gill 1973). A pressure bandage may be applied and the swelling drained (Rooney 1972). In chronic cases, if treatment is indicated, the swelling may be drained and corticosteroids injected aseptically (Adams 1974). However, Rooney (1972) comments that repeated injections of corticosteroids cause tendon degeneration. He also observed that in some long-standing cases adhesions formed between the tendon and tendon sheath, resulting in persistent irritation and effusion.

Bog Spavin: This disease is also known as tarsal hydrarthrosis and is a chronic distension of the tibio-tarsal joint capsule of the hock. There are three chracteristic fluctuating swellings, antero-medial, posterolateral and postero-medial. Of these three, the anteromedial is usually the largest. (Gill 1973) The posterior swellings are lower than those of thoroughpin. The characteristic sign is that if pressure is applied to one of the swellings, the others increase in size. The aetiology varies, and may be trauma, poor conformation, nutritional deficiency. Chip fractures or osteochondritis dissecans may also be present (Adams 1974). Affected horses are rarely lame, except in the acute stages or if there is a bony lesion (Adams 1974). Treatment should be aimed at removing the cause, wherever possible. In cases where the aetiology is trauma, intra-articular injection of corticosteroids may be used, with drainage of the swelling, rest and bandaging. (Adams 1974, Van Pelt and Riley 1967, Gill 1973) However, the lesion frequently refills in a relatively short length of time and arthritis of the joint may result from too many, or improperly performed, injections (Gill 1973). In most cases the main significance of this lesion is as a blemish. If the cause lies in nutritional imbalance, this should be corrected; if it is poor conformation, then nothing can be done.

Osteochondritis Dissecans: This disease affects primarily young horses, in many of the weight-bearing joints. Among these are the tibio-tarsal and intertarsal joints. The lesion consists of the separation/

separation of a piece of subchondral bone and attached articular cartilage from a convex articular surface. The animal may be affected bilaterally or unilaterally (De Moor et al, 1972). The aetiology is unsure, but it is thought to be due to ischaemia, resulting from an infarct in the epiphysis, and consequent necrosis of the affected portion of bone (Adams 1974). De Moor (1972) commented that another possible aetiology is a subchondral fracture. Lameness and swelling of the hock are features of the condition.

Radiography is valuable in the diagnosis of this disease, and separate bony densities of the intermediate coronoid process of the tibia may be seen, with a radiolucent line between the fragment and the main part of the bone, but no displacement (O'Brien 1975). Other bones in the hock that may be affected are the tibial tarsal, central, third and fourth tarsals. Fragmentation of the tarsal bones may occur, due to pressures forcing the affected portions anteriorly. (Adams 1974) Radiography reveals an area of decreased density on the articular surface.

This condition may be treated conservatively with fair success, the aim being to prevent weight-bearing on the affected limb and hence prevent displacement of the fragment. Provided that the fragment remains in position, it should heal back to the main part of the bone and become revascularised within three to seven months (Adams 1974). If this treatment is unsuccessful, or the fragment is loose, then removal of the loose body and curettage are indicated (De Moor 1972).

Necrosis of the Third Tarsal Bone: Morgan (1967) reports this as a separate entity. It is said to occur in foals and causes lameness and swelling of the hock. The condition is usually bilateral, and changes are probably present at, or prior to birth. This is an aseptic necrosis and possibly due to secondary hyperparathyroidism.

Curb: This is the name given to an inflammation and thickening of/

of the plantar ligament of the hock, causing a swelling on the plantar aspect of the calcaneus. Conditions predisposing to this include sickle and cow hocks, which stress the plantar ligament excessively. This condition may appear soon after birth because of poor conformation. Other factors implicated in producing this condition are violent exertion, or sharp extension of the hock and trauma. (Adams 1974)

In the acute phase, signs of inflammation and lameness are present and the typical swelling is visible, extending down the plantar aspect of the calcaneus and being most prominent opposite the tarso-metatarsal articulation. At this stage, the treatment is directed at reducing the inflammation, and consists of cold water hosing, phenylbutazone administration, injection of steroids and rest (Gill 1973). In cases caused by trauma, periostitis may arise on the calcaneus, producing new bone growth. In chronic cases, the area may remain enlarged due to the formation of scar tissue, making a permanent blemish. Firing or blistering of these cases may be used, Adams (1974) considers the value of this to be questionable, but Gill (1973) comments that firing is of some use.

A permanent blemish often results from this condition, but most animals are sound. In those animals with poor conformation, this may serve as a continuing irritation to the lesion and the prognosis is worse.

<u>Bursitis of the Cunean Tendon</u>: This is an inflammation and usually a swelling of the bursa of the cunean tendon. It may be present as a lesion alone, as described by Lutz and Gabel (1969), in the Standardbred trotter, or it may occur as a complicating factor in tarsal osteoarthritis (Adams 1974). This condition produces signs identical to tarsal osteoarthritis, and must be differentiated from it. Differentiation is achieved by the absence of radiographic abnormality and by injection of the bursa with local anaesthetic, which will produce soundness in an animal affected by only bursitis. If there is bursitis and arthritis,/

arthritis, there may be an improvement.(Gill 1973)

Cunean tenectomy is of value in cunean bursitis and its potential value can be judged by the result of local infiltration of the bursa. This condition tends to occur in young Standardbred trotters and pacers, which tend to have poorly formed hocks. There is seldom pain or heat in the area, and may be no swelling (Lutz and Gabel, 1969).

Luxation of the Superficial Flexor Tendon: The superficial flexor tendon may luxate medially or laterally from the point of the hock. Lateral luxation is the more common. This condition occurs when the strong band holding the tendon to the point of the hock is ruptured by some abnormal force. Initially there is marked lameness and some swelling in the area, as the tendon slips on and off the point of the hock during movement.

Two types of treatment are available, one being to rest the horse and allow the tendon to form a new bed in its luxated position, the other is surgery. An attempt may be made to replace the tendon in position, suture it to the supporting band, and prevent lateral movement by means of a steinmann pin inserted in tuber calcis. (Rooney 1972 and Gill 1973)

Fractures and other Traumatic Conditions: Various fractures occur in the tarsus, either traumatic or as a result of a pathological process, usually osteochondritis dissecans.

From reports in the literature, the most common fractures appear to be of the distal tibia, and of the talus. Most of these are chip fractures and involve either the articular surfaces of the tibio-tarsal joint, or the articulation of the talus with central tarsal. These fractures may be due to severe stress or to osteochondritis, when the necrotic fragment becomes displaced. (Adams 1974) Other fractures reported include various fractures of the calcaneus, usually in the young horse. Fractures of this bone, through both the body and the epiphysis are mentioned by O'Brien in 1973. A case of fracture of the third tarsal bone, in a horse with tarsal osteoarthritis is described/

described by Adams (1974). Small avulsion fractures may occur from any bone if a ligamentous attachment is pulled free.

The prognosis of fractures in the hock is guarded if the fragment is large or involves an articular surface (Adams 1974). Small fracture chips may be removed and larger ones replaced.

It is possible for ligamentous rupture and possibly dislocation, or fracture dislocation, to occur in the horse's hock (Adams, 1974; Wheat and Rhode, 1964). This is as a result of trauma. The malleoli of the tibia may fracture, resulting in some instability of the joint. Skin wounds also commonly result from trauma and there may also be penetration of the joint itself, leading to an inflammatory or infectious arthritis (O'Brien 1973). Arthritis resulting from infection with Brucella abortus is a special type of infectious arthritis, this may occur in any joint, and causes swelling and lameness.

OTHER HOCK LESIONS

CLINICAL CASES:

Case No. 1 - 6 year old Thoroughbred mare. Seen initially with sudden onset acute hind leg lameness while in the field. This was thought to be due to a kick. The right hock was swollen, and on radiography a chip fracture of the lateral malleolus and vertical fissure of medial malleolus, were present. On radiography 9 - 10 months later the fractures had healed and there was no development of tarsal osteoarthritis. The horse was sound.

Case No. 2 - 6 year old Thoroughbred cross Clydesdale hunter gelding 16.2hh. Presented with moderate lameness in left hind leg which was said to improve slightly then become worse again. The animal reacted very positively to the spavin test. Obvious distension was present in the sheath of the deep flexor tendon in both legs as a thoroughpin, that in the left leg being larger than the right. The left leg also showed distension extending below the point of the hock for about 4 inches, having almost the appearance of a curb. However, on pressure, this swelling fluctuated and the swelling of thoroughpin increased in size, thus the two were presumed to communicate. On radiography, no abnormality was detected. It was decided that the horse was unlikely to make a complete recovery and he was euthanised.

At post-mortem, the tarsal sheath of the deep flexor tendon was distended and contained excess synovial fluid in both legs. In the left leg, there were fibrin strands in the tendon sheath. The deep flexor tendon, at the point where it passed over the plantar aspect of talus and calcaneus, was partially ruptured on the dorsal aspect. The fibres were broken and splayed out in the superficial 2-3 mm. of the tendon for a length of about 3 cm. They were adhered in this splayed position to the body of the tendon. The tendon of the other leg was normal./

normal. There was also a high ringbone on the affected leg.

Case No. 3 - 12 year old 16 hh half-bred brood mare. This mare was in foal and turned out in a field alone when the injury occurred. She was found very lame, with a grossly swollen right hock. There was a small puncture medially on this hock, with what the owner considered to be synovial fluid running from it. This small wound quickly healed and became invisible. The practitioner advised box rest and gave antibiotics. Three weeks later, the general condition of the animal had gradually deteriorated and the lameness was no better, so the case was referred to the Veterinary Hospital for examination and radiography. The radiographs were not of good quality, as the horse would not bear weight on the leg, which moved constantly. However, no chip fractures or other bony abnormality could be seen, so further rest was advised.

A month later, there was still no improvement. Further radiographs were obtained but no abnormality was detected. Synovial fluid samples were cultured, but no bacteria were found, and blood samples tested for brucellosis were negative. Phenylbutazone powders were administered, as pain from the affected hock had decreased the mare's appetite and hence she had lost a considerable amount of condition. This treatment resulted in an improvement in the lameness and also in the general disposition and condition of the animal. It was hoped to keep the mare alive in relative comfort until she foaled, then euthanise her if there had been no improvement. However, 2 weeks later (i.e. 9 weeks after the injury), she lay down in the stable, was unable to rise, and it was considered best to destroy her.

At post-mortem, the affected hock was still grossly swollen. There was excess fluid in the tibio-tarsal joint and synovitis was evident. On examination of the articular surfaces, a defect was found in the lateral trochlear ridge of talus (Fig. 42), which was approximately circular. It was filled initially with soft/

soft material, which was easily removed.

The bones were macerated by boiling, then degreased and this defect was found to be a well defined hole. There were also defects in the distal articular surface of talus and proximal aspect of central tarsal (Fig. 43). The cause of this remains unknown, it can only be postulated that this damage was caused by an infective or inflammatory arthritis.

Case No. 4 - 9 year old 14.1 hh. jumping pony. This pony had been owned for 12 months. Just after purchase, a swelling, accompanied by lameness, appeared above the point of the hock in the area just dorsal to the achilles tendon. This began to discharge pus, and was opened in two places to facilitate drainage. Poultices were applied. This damage healed well and the pony had since been jumping. A similar swelling had appeared one month prior to presentation, whilst at exercise. Mild lameness was present. The swelling had two distinct components, one appearing to be between the tendons of superficial flexor and gastrocnemius, the other between gastrocnemius and the tarsal tendon of biceps femoris.

The swelling was considered to be caused by distension of the bursa beneath superficial flexor tendon and the bursa beneath the insertion of gastrocnemius. An attempt was made to withdraw a sample of the fluid and a small amount of relatively normal synovia was obtained before a blood vessel was punctured, causing the fluid to suddenly become bloodstained. A radiograph was taken to check for the presence of foreign bodies but none could be seen.

Rest was advised for at least 2 or 3 months, as the lesion was presumed to be due to a strain, probably to tissues affected by the previous inflammation.

Case No. 5 - 4 year old Thoroughbred mare, 16.1 hh. This mare had been owned by the present owner for several months, and had been lame for about six weeks. The lameness began after the horse had been jumped at home. When seen at Glasgow University/

University Veterinary Hospital, the horse was only mildly lame in the left hind, and the hock was slightly swollen, the swelling apparently being in the tibio-tarsal joint. The "spavin test" was positive on this leg.

The owners reported that the lameness and swelling had both improved markedly initially, then remained the same. The mare had a curb on this leg four months before the onset of this lameness. The referring veterinary surgeon suspected an "occult spavin".

Radiography of the hock (two oblique views) revealed no abnormality. The joint spaces of the tarsus were visible and clear. A blood sample was taken for Brucella antibody estimation, the titre was 1.20, which is usually insignificant. To check for a rising titre, a second sample was taken two weeks later and the titre was the same, proving the first result to be of no significance.

On the history given and clinical signs evident, it was considered that the lesion was probably an acute strain of the hock.

<u>Case No. 6</u> - 11 year old jumping pony, 13.2 hh. This pony had been lame for 5 weeks when seen. He was moderately lame in the left hind leg and had become lame when out grazing. The owner thought that he had possibly been kicked. The left hock was initially very swollen, this swelling gradually decreased, but a hard swelling remained on the plantar medial aspect of the joint. The lameness was said to have improved since its onset. The "spavin test" on the left hind leg was positive.

On radiography, a reactive area of new bone formation was seen on the plantar aspect of sustentaculum tali. It is possible that this interfered with the deep flexor tendon in the tarsal canal. This syndrome was reported by Edwards (1976). The cases seen by him all remained lame and on post-mortem showed fibrillation of the deep flexor tendon. The owners were advised to rest this animal and return him for further radiography in 2 months.

These figures show bones of the right hock of case no.3 in this section.

FIG 42.

On the right of this photograph is the proximal surface of talus. The cavity in the lateral trochlear ridge can be seen(C). This was about 0.8cm. deep. There is a marked synovial fossa(F). The medial aspect of the talus was roughened and had some exostoses on proximal and distal tuberosities.

The calcaneus, on the left of the photograph, shows exposed cancellous bone on the articular surfaces(U). There were corresponding areas of erosion on the articular surfaces on the plantar aspect of talus. Exostosis is visible around the margins of the articular area of sustentaculum tali(E).

FIG 43.

On the right of this illustration is the distal surface of talus. This has a cavity(C) and an area of roughening of the non-articular groove(R) and erosion of articular edge. The left hand side of the photograph shows the proximal articular surface of central tarsal. There are three small cavities(C) and the non-articular groove is roughened(R). There is a minor degree of exostosis medially(E).


U
U
E
U
F
C

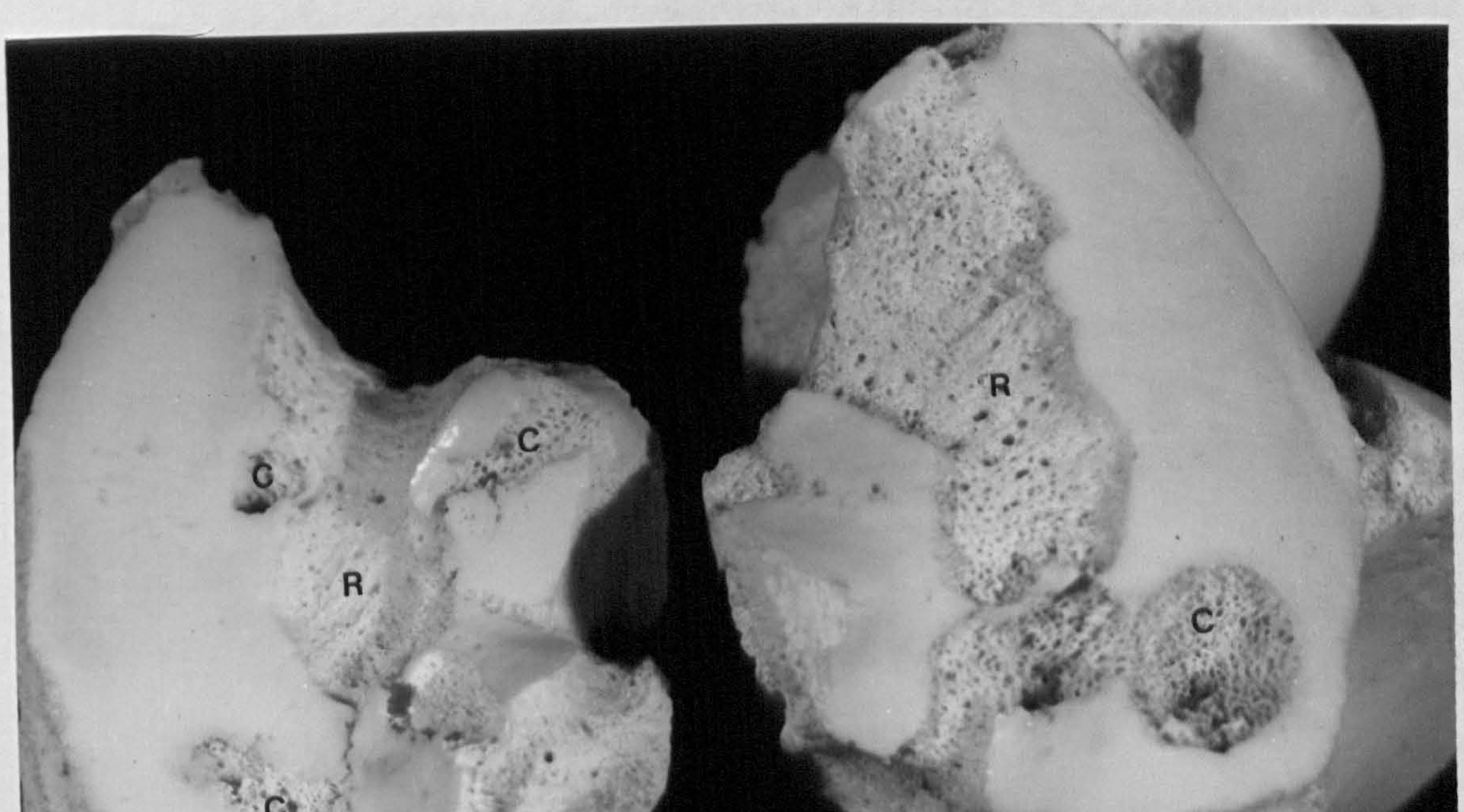

C
C
R
C
E
R
C

Fig. 44.

This is a slightly oblique radiograph, from caudolateral to craniomedial, of the left hock of case 6 in this section. The exostosis on the plantar aspect of sustentaculum tali is just visible, it is indicated by the white arrow.

SECTION 4

GENERAL DISCUSSION

GENERAL DISCUSSION

Tarsal osteoarthritis is the most common articular disease of the pelvic limb, (Vaughan 1965) and the most common disease of the hock joint. Because of this relatively high incidence, in some cases lameness due to other diseases may be attributed to "a spavin". This has been seen in several cases referred to Glasgow University Veterinary School in the period October 1976 - July 1977. This confusion occurs because animals are not subjected to adequate radiographic examination, which will demonstrate lesions of tarsal osteoarthritis.

Other hock lesions account for a moderate percentage of pelvic limb lameness in the horse, but some of the diseases do not produce lameness for more than a short length of time. Diseases falling into this category include curb, tarsal hydrarthrosis and thoroughpin. These diseases are fairly common, of little clinical significance in most cases, and are readily diagnosed by their appearance.

The other causes of hock lameness which are of clinical importance and may produce intractable lameness are various fractures, osteochondritis dissecans, and joint infections of different types. These problems are relatively uncommon and may all prove difficult, if not impossible, to cure, causing the affected animal to become useless.

Thus, disease of the hock is an important cause of equine lameness. Unlike lameness of the hip or stifle, it can, if proper measures are taken, be accurately diagnosed in most cases and thus a suitable treatment decided on, and a more accurate prognosis given.

Treatment of tarsal osteoarthritis has long been a subject for discussion and success cannot be achieved in all cases. However, it seems likely that better results could be obtained by the adoption of different forms of treatment for different types of case, than by using one standard treatment. Thus, as a first line of treatment in cases where a rapid return to work is not of great importance,/

importance, and radiographically demonstrable lesions are not severe, the animal could be worked lightly, and given phenylbutazone or a similar drug. If the animal remained too lame even to be worked lightly, then rest could be tried. In a long-standing case, one in which the preceding treatment has produced no significant radiologic and clinical improvement, or one in which a rapid return of function is required, then surgery should be considered.

Wamberg's operation or similar forms of cunean tenectomy are useful in cases where the lesions are mainly on the dorso-medial aspect of the joint space of distal intertarsal or tarso-metatarsal joints, or periarticular in this area. This is due to the relief of cunean bursitis and pressure on the exostosis (if present). In cases with more extensive intra-articular changes, proximal intertarsal joint involvement, or a history of failure with other methods of treatment, Adams' ankylosis operation is valuable. Cases treated conservatively should be monitored radiographically to assess progress. If there is evidence of deterioration of the condition, and radiographic evidence of extensive subchondral lysis, rather than progressing ankylosis, then ankylosis should be attempted by surgical means.

The majority of horses affected by tarsal osteoarthritis eventually return to usefulness, the exact percentage stated varies from one author to another, and also depends on criteria used for diagnosis initially, and the assessment of what constitutes 'soundness'. Accurate diagnosis, using radiography, coupled with appropriate selection of treatment, could increase the speed, and percentage of recoveries from this condition.

SECTION 5.

LIST OF REFERENCES.

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