Ligamentous injuries to the canine hock

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ABSTRACT
Ligamentous damage to the canine hock is a relatively uncommon orthopaedic injury. Severe trauma seems to be necessary to produce it. Four cases of tarsal ligamentous damage are reported. Their management is described and discussed along with a brief review of the relevant literature.

INTRODUCTION
Here is a low incidence of hock lameness in small animals compared to humans, whom ankle injuries are very common (Reimers et al., 1972). In a survey of a 1-year period, Arwedsson (1954) found only five cases of plantar tarso-metatarsal luxations had been presented at the Royal Veterinary College, Stockholm.

At the Small Animal Clinic of the Faculty of Veterinary Medicine, University of Nairobi, out of 1,340 cases (all species) presented for orthopaedic reasons over the past 7 years, only nineteen had hock lameness. Of these, seven had sustained ligamentous damage only (six dogs and one rabbit), five were showing ligamentous avulsion fractures (where the ligament remained intact but a piece of bone at the insertion of the ligament had become detached), five had fractures of the tarsal bones and in two there was soft tissue trauma around the hock with no bony abnormalities. The purpose of this paper is to present some cases with ligamentous damage only, and to discuss their management.

The stability of the canine tarsus is maintained by a series of interosseous ligaments. Most proximally are the medial (tibial) and lateral (fibular) collateral ligaments; within the tarsus itself are the intertarsal ligaments, while distally are the tarso-metatarsal ligaments (Figs 1a and 1b). Any one, or combination, of these ligaments may be affected. Of the six cases seen, there was damage to both collateral ligaments in three, the medial collateral ligament in one and the

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457
Fig. 1a. Ligaments of left tarsus (after Miller, 1964)—medial view. TF, Fibular tarsal bone. TT, Tibial tarsal bone. TC, Central tarsal bone. T2, Second tarsal bone. T3, Third tarsal bone. I, First metatarsal bone. II, Second metatarsal bone. III, Third metatarsal bone.

Fig. 1b. Ligaments of left tarsus (after Miller, 1964)—lateral view. T4, Fourth tarsal bone. V, Fifth metatarsal bone.
LIGAMENTOUS INJURIES TO THE CANINE HOCK

ntertarsal ligaments in two, one of which latter also had damage to the tarso-
metatarsal and inter-metatarsal ligaments.

CASE REPORTS

Case 1 (10993)
This was a 7-year-old Alsatian bitch found on the road after having been
struck by a car. It was paraplegic due to a fracture-dislocation of the eleventh
thoracic vertebra and it had a complete rupture of the medial collateral ligament
of the right hock, allowing opening of the tibio-tarsal joint medially. The latter was
confirmed radiographically. The fracture-dislocation of the vertebral column was
treated conservatively but the ruptured hock ligament was treated surgically.

The approach was through a skin incision starting above the medial malleolus
and continuing antero-ventrally to end at the head of the second metatarsal
bone. Dissection through the underlying fascia then exposed the malleolus, medial
ligaments and tendons. The long part of the medial collateral ligament was too
badly torn to repair and so was excised. The short part was repaired using two

![Fig. 2. Antero-medial diagram of right tarsus of Case 1 to show position of prosthetic ligament.](image-url)
figure-of eight sutures of No. 0 monofilament nylon. To improve the medial stability during healing, a prosthetic medial collateral ligament was made by drilling an opening antero-posteriorly through the medial malleolus and an dorso-ventrally through the medial part of the head of the tibial tarsal using a 0.045 in. Kirschner wire as a drill. The prosthetic ligament, No. 1 n filament nylon, was threaded through both holes, tied as a single loop and b deep to the remains of the existing ligaments (Fig. 2).

One week after surgery, the dog began to walk again but was extremely unand paretic on the hind legs, placing a lot of stress on the hock, even though exc was restricted. Nine months later, however, the dog was walking very (although still slightly paretic) and with no joint instability in the right hock. extension was possible but flexion was limited by 15°. Radiography (Fi revealed minor exostoses around the medial malleolus and the medial ridge of tibial tarsal bone. Fifteen months after surgery there was no lameness although very slight paresis remained.

![Antero-posterior radiograph of right tarsus of Case 1, 9 months after surgery.](image)
A 1-year-old mongrel male presented after a car accident the previous day. There was an open wound on the medial side of the left hock through which the distal end of the tibia/fibula was protruding. Clinical examination and radiography confirmed this was a tibio-tarsal dislocation without any accompanying fracture (Fig. 4).

The repair technique used in this case was as described by Hickman (1964). A nonfilament stainless steel wire as a continuous loop is passed transversely through a track in the distal end of the tibia/fibula and through a second hole drilled transversely through the tibial tarsal bone. The wire is then joined to itself after reduction of the luxation and tightened to act as a prosthetic replacement for both collateral ligaments. Post-operative radiographs showed satisfactory reduction (Fig. 5). No review was possible on this dog since, shortly after surgery, the owners left the country.
Case 3 (10855)

A 4-year-old Dachshund male had been attacked by a Labrador and Alsatian. Its injury comprised a tibio-tarsal luxation due to tear of both collateral ligaments (Fig. 6).

The ligaments were repaired using No. 3 monofilament nylon in a similar fashion to Case 1 except that the holes drilled medially were taken through the central and third tarsal bones. Tibial holes were also drilled laterally through the malleolus and the disto-lateral part of the fibular tarsal bone (Fig. 7). The torn proximal ends of the medial and lateral collateral ligaments were sutured to the bone using No. 3 monofilament in figure-of-eight sutures through the holes in the respective malleoli. After surgery a support bandage was applied. Five days later, the dog began to use the limb intermittently and 1 month later it was walking well with only slight lameness. Two months after surgery the owners reported that the dog was not lame.
Fig. 6. Lateral radiograph of right tarsus of Case 3—as presented.

Fig. 7. Antero-posterior radiograph of right tarsus of Case 3—9 months after surgery.
A review, with radiographs (Fig. 7) 9 months after surgery showed no laminar widening although the owners stated that the dog carried the leg when going downstairs. There was full range of flexion and extension and no joint instability, crepitus or pain.

Case 4 (7456)

A 4-year-old male Rough Collie was presented the day after being in a dog fight. There was gross lateral instability of the right tarso-metatarsal joint which was confirmed on A-P radiography taken with the foot forced medially (Fig. 8a). There was also intertarsal luxation of the first, second and third tarsal bones and intermetatarsal luxation between metatarsals three and four. A lateral radiograph (Fig. 8b) revealed a tarso-metatarsal sub-luxation. The lateral tarso-metatarsal joint instability was thought to be due to rupture of the combined insertion of the long part of the lateral collateral ligament and the ligamentous abductor digiti quinti muscle on to the lateral head of the fifth metatarsal bone (Fig. 8b), combined...
LIGAMENTOUS INJURIES TO THE CANINE HOCK

Fig. 8b. Lateral radiograph of right tarsus of Case 4—as presented.

...some plantar ligament damage. Since most of the instability at physical examination appeared to be at the lateral tarso-metatarsal joint, it was decided to correct this surgically and then apply external support.

A lateral approach to the tarso-metatarsal joint revealed a small bone fragment (not visible on Figs 8a or 8b) to have become detached from the lateral head of the metatarsal bone with the insertions of the long part of the lateral collateral ligament and the abductor digitii quinti muscle still attached. This fragment was reduced back to the fifth metatarsal bone with braided 3/0 stainless steel wire. A post-operative radiographic check (Figs 9a and 9b) showed satisfactory reduction. There was now no lateral instability and aluminium padded splints (Finger splints—Invalid Equipment, Nairobi) were applied as an external support.

The dog was discharged for strict rest but when it returned for a check 3 weeks after surgery, total disruption of the joint had recurred (Figs 10a and 10b), with the wire suture torn from its attachment to the fifth metatarsal bone. It was decided that arthrodesis would be required.

A lateral skin flap incision was made to expose the lateral and dorsal parts of the tarsus (Fig. 11). The remains of the wire suture were removed and the joint faces of the distal and axial fourth tarsal bone, the axial surfaces of central third tarsal bones, the distal surface of the third tarsal bone, the proximal art surfaces of the metatarsal bones and the axial aspects of the proximal parts of the third and fourth metatarsals were curetted. Fixation was accomplished by means of a 3½ in. Venable bone plate in which an extra hole had been drilled.
Figs 9a and 9b. Antero-posterior and lateral radiograph of right tarsus of Case 4—after initial surgery.
Figs 10a and 10b. Lateral and antero-posterior radiographs of right tarsus of Case 4—3 weeks after initial surgery.
This was fixed laterally to the tarsus by means of two 9/64 in. screws into the fibular tarsal bone, one 7/64 in. screw placed across the fourth and central tarsal bones and two 7/64 in. screws across the second to fifth metatarsal bones. The 7/64 screws were introduced using the lag principle to afford compression between the fourth and central tarsal bones, and between the third and fourth metatarsal bones (Figs 12a and 12b). Aluminium padded finger splints were again applied externally after closure of the skin flap.

Three days after surgery, when the external support was removed, there were discharging (sero-sanguinous) sinuses from the metatarsal area of the surgical wound and dark discoloration of the anterior aspect of the distal metatarsal/proximal phalangeal region. This discoloured area rapidly sloughed over the next 2 days exposing the bone (Figs 11 and 13). This area was totally healed after a further 2 months but, despite antibiotic treatment based on bacteriological sensitivity the discharging sinuses persisted. Radiographs at this time showed a severe osteomyelitis in the proximal metatarsal region which was treated by removal.
Figs 12a and 12b. Lateral and antero-posterior radiographs of right tarsus of Case 4 after attempted arthrodesis with plate and screws.
FIG. 13. Close-up view of dorsum of right hind foot of Case 4 to show soft-tissue necrosis (taken during healing of the area).

FIG. 14. Antero-posterior radiograph of the right tarsus of Case 4 taken 1 month after removal of plate and screws.
Figs 15a and 15b. Lateral and antero-posterior radiographs of the right tarsus of Case 4—taken 3 months after sequestrum removal.
the plate and screws and insertion of perforated polythene drainage tut
allow antibiotic flushing of the area.

The sinuses refused to heal, however, and further X-rays taken one n
later revealed a sequestrum (Fig. 14). This was removed surgically and ext
support applied using a reinforced Orthoplast splint ('Orthoplast' Iso
Splints—Johnson and Johnson). Six weeks after sequestrectomy, external suppo
discontinued revealing no sinuses present. Three months later the dog was we
well although not bearing full weight on the leg. Excess callus, demonstrat
radiography (Figs 15a and 15b), was palpable in the metatarsal region but
was no mobility. The normal range of tibio-tarsal joint movements were pr
with no evidence of pain.

A verbal report by the owner 15 months after the initial presentation of the
indicated that the dog had regained full leg use.

DISCUSSION

It is difficult to draw any significant conclusions about the incidence of ru
of the different ligaments in the tarsus because of the small number of
involved. Since cases 1, 3 and 4 are still living and case 2 is unavailable,
mortem examination to determine the fate of the prosthetic ligaments use
cases 1 and 3 and also to determine whether the repair of the existing ligan
was effective, has not been possible. A discussion of the cases reported
however, might be useful.

Cases 1, 2 and 3 are similar in that rupture of one or both collateral ligan
had occurred. Bilateral rupture is easily diagnosed since it presents as a t
arsal luxation, readily discernible on clinical examination and radiogra
Unilateral rupture of either the medial or lateral ligaments is also fairly ob
because of the easily visualized gross trauma which seems to be needed to c
the lesion and also by the ability to open the tibio-tarsal joint on the affected
Inversion (i.e. twisting the lateral part of the foot ventrally) or eversion (twi.
the medial part of the foot ventrally) at the time of antero-posterior radiogr:
of the tarsus makes this opening much more apparent (Watson-Jones, 1956)
also facilitates demonstration of any minute bone fragments. This could be ac
plished under light anaesthesia or even sedation since the cases seen so far shc
very little pain on manipulation (unlike the human ankle injury which is extre
painful).

In cases 1 and 3 the ligaments were repaired as much as possible and prost
nylon ligaments inserted as described. The variation in the positions of the d
holes which were drilled is due to the relative positions of the tarsal bones b
obscured at surgery. There are easily palpable bony protuberances on the ta
medially one is formed by the disto-medial part of the head of the tibial t:
bone and the central tarsal bone; laterally, the protuberance is formed by
disto-lateral part of the fibular tarsal bone and the fourth tarsal bone. At su
These protuberances were palpated as useful places to drill the holes for the distal attachments of the prosthetic ligaments, but it was difficult to locate these holes accurately through a particular tarsal bone; hence the variation in their positions on post-operative radiography. Follow-up examinations and radiographs of this limited number of cases, however, indicate that this variation in position produces no difference in the long-term results. The method of Hickman (1964) to replace both collateral ligaments is described in case 2. Hickman (1964) also describes a method of replacing a unilateral, ruptured collateral tarsal ligament using a monofilament wire placed as a figure-of-eight around two Sherman screws inserted at the origin and insertion of the collateral ligament. In this method, the insertion of the ligament is more proximally on the tarsus than the method described here.

Leonard (1971) describes the use of a Kirschner intra-medullary pin after reduction of the tibio-tarsal luxation for fixation; the pin is drilled through the tibial and ibular tarsal bones into the medullary canal of the tibia with the hock in mild flexion. He recommends coaptation as a precaution against rotation.

In the human literature Watson-Jones (1956) has described the use of the tendon of the peroneus brevis muscle which inserts on the lateral head of the fifth metatarsal as does the long part of the lateral collateral ligament to replace the lateral ligament. So far, no cases of lateral ligament rupture in the dog have been presented here but canine cadaveric work shows that a similar operation is possible. Watson-Jones (1956) has also described the use of the tendon of the peroneus longus muscle to replace both collateral ligaments in the human but this seems rather a complex piece of surgery for use in the dog compared to the methods already described above. The only mention of use of a tendon in a canine tibio-tarsal dislocation is by Wood (1957) but his anatomical account is vague.

Case 4 was a rather complicated case of tarso-metatarsal dislocation with inter-tarsal subluxation. In the veterinary literature, tarso-metatarsal subluxation has been described by Arwedsson (1954) and intertarsal subluxation by Lawson (1969). Tarso-metatarsal dislocations and fracture-dislocations are well-documented in the human literature (Cassebaum, 1963; Del Sel, 1955; Gissane, 1951; Jeffreys, 1963; Watson-Jones, 1956) and are named after Jacques Lisfranc who, in the 19th century during the Napoleonic wars, devised a technique of amputation through the tarso-metatarsal joint.

In human cases of Lisfranc's fracture-dislocation, both conservative and surgical methods have been used with some success. In the dog, however, Arwedsson (1954) stated that conservative methods of treatment of tarso-metatarsal subluxation were unsatisfactory, resulting in permanent lameness and describes arthrodesis of the tarso-metatarsal joint by debridement of the joint surfaces and the use of a pin-cast to maintain alignment. Lawson (1969) also mentioned that it was not possible to maintain realignment of first inter-tarsal joint subluxations by conservative means and described arthrodesis of this joint using an olecranon screw for compression after the joint surfaces had been debrided.
The results of the first operation in Case 4 illustrate clearly that Arwedsson (1954) and Lawson’s (1969) approaches would have been preferable (see 10a and 10b). The method of arthrodesis described using a plate and screws preferred to those of Arwedsson (1954) and Lawson (1969) in this case because neither of these latter would have produced compression in the direction to correct the intertarsal and inter-metatarsal subluxations.

The soft-tissue necrosis of the foot, despite copious padding during each support, and the bone sequestration which occurred in Case 4 could have resulted from the surgical trauma of the second operation causing damage vessels supplying the area. Gissane (1951), however, described Lisfranc’s fiss dislocation as ‘a dangerous type of fracture of the foot’ since, over a 10-year period, three cases which were treated conservatively with, therefore, no surgical treatment had to have the leg amputated below the knee because of necrosis of the foot. This suggests that this is a form of ischaemic necrosis due to damage to the vessels of the foot at the time of the injury. He is quoted in this respect by authors (Cassebaum, 1963; Jeffreys, 1963; Del Sel, 1955; Watson-Jones, 1963) although only Cassiebaum (1963) and Jeffreys (1963), in their series, reported each case requiring amputation of any degree.

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REFERENCES

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Edinburgh and London.

Résumé. Le jarret canin atteint d’un dommage ligamenteux est un accident orthopédique relativement rare. De sévères traumatiques semblent nécessaires pour qu’il se produise. On rapporte quatre de dommages ligamenteux tarsien. On décrit et on discute de la manière dont on les traite avec brève revue des documents courants.