Straelensiosis in dogs: a newly described nodular dermatitis induced by *Straelensia cynotis*

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A distinctive nodular dermatitis induced by *Straelensia cynotis*, a newly described trombidioid larval mite which resides in hair follicles, was identified in 12 dogs living in France. They all had scattered, small (1 to 3 mm in diameter), pale, firm skin nodules, variable in distribution but always affecting the dorsal regions of the head and trunk; they were distributed over the whole body of seven of the dogs. The animals were otherwise healthy except for three severely infested fox terriers which had a decreased appetite, were lethargic, and whose skin nodules were painful to the touch. The nodules did not induce pruritus. The lesions usually began as erythematous papules which developed into firm pale nodules. The dermatitis resolved within two to 12 months. Topical acaricides were ineffective but the skin nodules regressed after treatments with systemic avermectins. Histologically, each nodule was composed of a dilated follicular ostium containing a well-preserved larval mite, and showed a pseudoepitheliomatous follicular hyperplasia and an abundant perifollicular mucinosis. The larvae were identified as belonging to the genus *Straelensia* (Acari: Leeuwenhoekiidae). It was clearly established that the three fox terriers had become infested within a fox's den. The nymphs and adults of this species of mite are believed to live in foxes' dens; foxes are considered to be the natural host for the larval stage, and dogs a permissive but occasional host.

THE nymphs and adults of trombidioid mites (families Trombiculidae or Leeuwenhoekiidae) are either free living or parasitise plants or other arthropods, but their larval stage (also known as chiggers) must feed on a vertebrate host (Yager and Scott 1993). Wild animals are their usual hosts but food-producing domestic animals, pets and people are infested accidentally. In Europe, the most common trombiculidiasis is induced by *Neotrombicula autumnalis*, the European harvest mite, which infests most species, including dogs.

At the 24th World Small Animal Veterinary Association congress in Lyon, France, the occurrence of a distinctive nodular dermatitis in dogs living in France induced by a larval mite of the genus *Straelensia*, family Leeuwenhoekiidae (superfamily Trombidioidea) was reported for the first time (Le Net and others 1999). The morphological characteristics of this new species of mite were recently described and the name *Straelensia cynotis* was proposed (Fain and Le Net 2000). This paper describes the typical clinicopathological features of this dermatitis, observed in 12 dogs.

MATERIALS AND METHODS

Straelensiosis was diagnosed on skin biopsies taken from 10 dogs between 1991 and 2000. The same diagnosis was established clinically on two fox terriers which were from the same kennel as one of the 10 dogs. Full-thickness biopsies were fixed in 10 per cent neutral buffered formalin, processed in an automatic tissue processor, embedded in paraffin, sectioned at 4 to 6 µm and stained with haematoxylin and eosin. A few days after the initial histological diagnosis, additional biopsies were taken from two dogs, immersed in alcohol, and used to identify the parasite; approximately 12 nodules were dissected. The larvae were mounted in Hoyer's medium and examined under a microscope (Fain and Le Net 2000). Clinical data and the history of each dog were obtained from the referring veterinarian and the owner.

RESULTS

Clinical history

There were no apparent sex or age predispositions to the condition (Table 1). Various breeds were affected, with a strong predisposition for hunting dogs. Eleven of the 12 lived in south or south-west France, and the other lived in central France but frequently stayed near Bordeaux. They were all outdoor dogs, lived in rural areas, and regularly visited woodland; nine were actively used for hunting. The date when the disease was first noticed (usually one to two months before the biopsies) was evenly distributed among the seasons.

Clinical signs

All the dogs had a nodular dermatitis with multiple, small (1 to 3 mm in diameter), pale skin nodules on the dorsal regions of the head (muzzle and scalp) and dorsum (Figs 1, 2). The dorsal aspect of the front legs and tail were also involved in most cases. In seven of the dogs, the nodules were distributed more generally (Fig 3). The nodules were discrete, slightly raised and firm. They were often described by the owners as implanted cutaneous 'hunting leads'. They did not induce a pruritic reaction. Pruritus was observed only in dog 4 and was attributed to flea and lice infestations.

Skin scrapings or pressure applied to the firm nodules did not release any causative organism. However, in dog 4, the nodules were purulent and the clinician saw an 'atypical' mite species within the suppurative exudate.

The dermatitis was not contagious for the owners or for animals living in the vicinity, for example, the pups of one affected bitch did not become infected.

TABLE 1: Breed, age, sex and date of infestation of 12 dogs with straelensiosis

Dog	Breed	Age (years)	Sex	Date of infestation
1	Dachshund	1·5	M	May 1991
2	Boxer	7	F	November 1991
3	Jack Russell terrier	4	F	December 1995
4	Brittany spaniel	3	M	April 1997
5	Cross beagle	1·5	F	August 1997
6	Cross spaniel	1·5	F	April 1999
7	Cairn terrier	6	M	October 1999
8	Fox terrier*	5	F	May 2000
9	Fox terrier*	5	M	May 2000
10	Fox terrier*	8	F	May 2000
11	Siberian husky	1·5	F	July 2000
12	Brittany spaniel	2	F	December 2000

* Dogs from the same kennel

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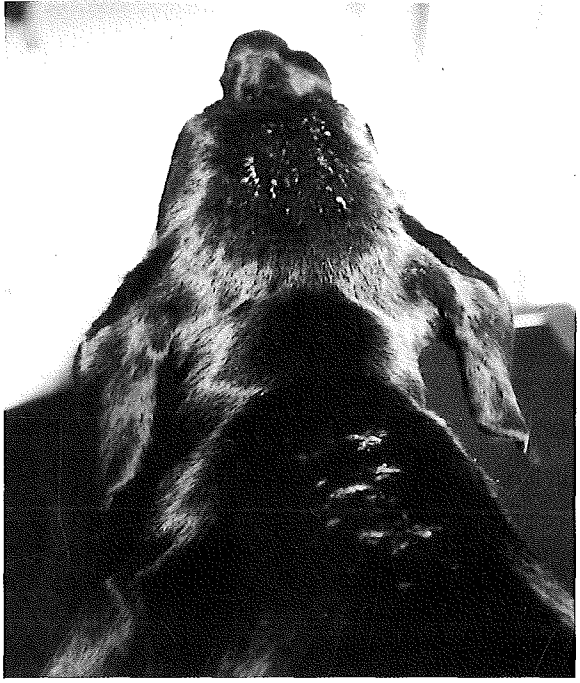

FIG 1: Cross spaniel (dog 6) with multiple, slightly raised, pale, small nodules on the dorsal regions of the head and trunk (photo Dr Dupin)

FIG 2: Dachshund (dog 1) with a few raised pale nodules between the eyes (photo Dr Crochelet)

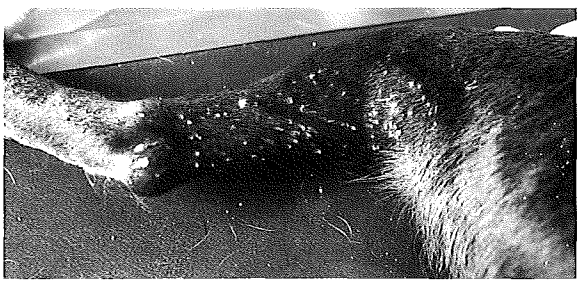

FIG 3: Cross spaniel (dog 6) with multiple nodules on the caudal region of the hindleg (photo Dr Dupin)

Apart from the nodular dermatitis, the dogs were otherwise healthy except for the three fox terriers which were the most severely infested animals; their appetites were reduced, they were lethargic and their skin nodules were painful to the touch.

Development of the disease

The disease lasted for two to 12 months, with a median duration of three months. The duration of the feeding period of *S cynotis* was determined to be at least three months in the three fox terriers which were kept indoors after the onset of the dermatitis. In the other dogs, it could not be determined whether the duration of the disease corresponded to the natural life cycle of the larval mite or to continual reinfestation. In a few of the dogs, the dermatitis appeared to wax and wane, possibly indicating a continual reinfestation. After a complete remission, none of the dogs has so far been reported to have been reinfested.

In most of the dogs the disease began with multiple erythematous papules which developed into firm pale nodules, crusts and progressive dissipation. In dog 4, the generalised bacterial contamination of the nodules was followed quickly by the termination of the disease.

Topical acaricides, including fipronil sprays, were ineffective. Nine of the 12 dogs received systemic treatment with avermectins, and although not all of them could be investigated thoroughly, most were reported to have a significant reduction in the number of skin nodules. In three of the dogs, the disease was reported to clear up spontaneously.

Histopathology

Microscopically, the nodules were composed of a dilated follicular ostium which contained a well-preserved larval arthropod, and showed a marked pseudoepitheliomatous follicular hyperplasia and a perifollicular mucinosis (Fig 4). The pseudoepitheliomatous follicular hyperplasia and the abundant perifollicular mucinosis which expanded the dermis locally were typical and can be considered pathognomonic of this condition (Fig 5). Additional step sections were often needed to visualise the larval mites. Neovascularisation was prominent around the follicle, but the infiltration of inflammatory cells was variable and usually slight, with an absence of eosinophils or mast cells. In dog 4, the nodules were almost completely effaced by a severe suppurative follicular and peri-

FIG 4: Skin nodule of dog 2, composed of dilated follicular ostium containing a larval arthropod, marked follicular hyperplasia with ballooning degeneration and perifollicular mucinosis. Haematoxylin and eosin. x 100

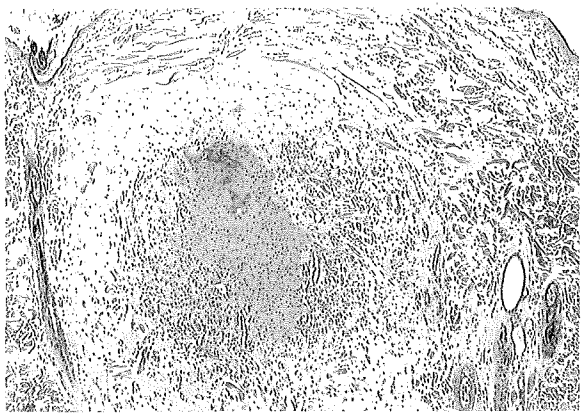

FIG 5: Pathognomonic histological changes of pseudoepitheliomatous follicular hyperplasia and abundant perifollicular mucinosis in dog 3. Haematoxylin and eosin. x 63

follicular inflammation (furunculosis): foci of dermal mucinosis were the only distinctive feature from the commonly observed bacterial furunculosis.

The larva was surrounded by an incomplete deep eosinophilic, sometimes mineralised, amorphous tube which opened at the epidermal surface and communicated with the underlying dermis through a fine aperture which was rarely visible in histological sections. There was no clear demarcation between the eosinophilic tube and the keratinised follicular epithelium. The larvae were always in the same position within the tube, the mouthparts placed towards the dermis, the posterior end towards the superficial opening and covered with chigger excrement (Fig 6). Striated muscles, jointed appendages and striated cuticle covered with thin barbs could also be identified (Fig 7).

Parasitological evaluation

The parasite was identified as a larval mite of the genus *Straelensia*, family Leeuwenhoekiidae. The larvae were approximately 700 x 425 µm in size, with six legs, typical chelicerae and a body covered with thin barbs (Fig 8). A full description has been published by Fain and Le Net (2000).

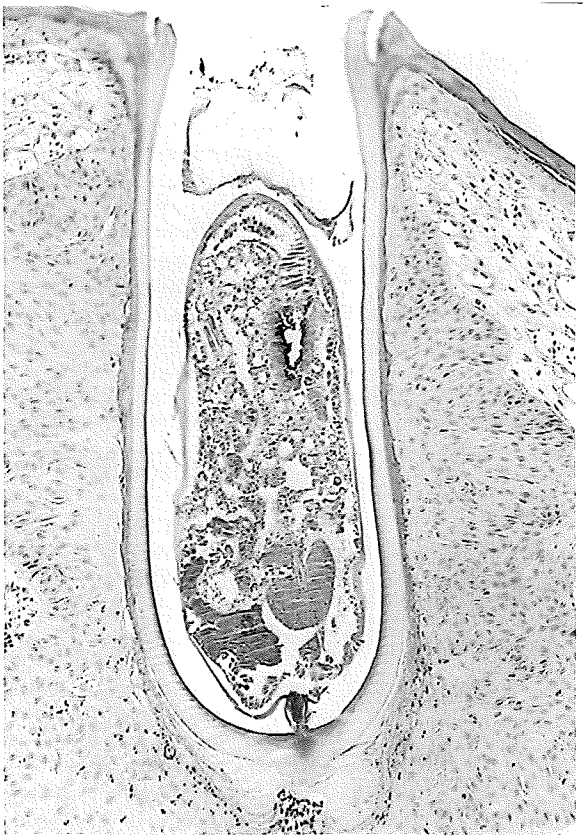

FIG 6: Dilated follicular ostium containing a well-preserved larval arthropod (dog 7). Its mouthparts are towards the dermis and the posterior end is at the superficial opening, covered with chigger excrement. Haematoxylin and eosin. x 200

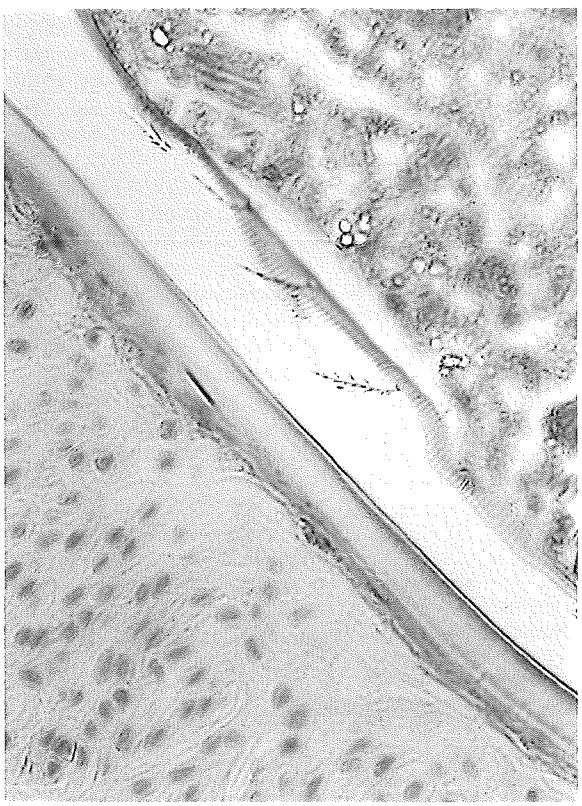

FIG 7: Thin barbs on the striated cuticle of the parasite in dog 7. Haematoxylin and eosin. x 400

Origin of the infestation

The origin of the infestation could be clearly established in the three fox terriers. On May 14, 2000, they were the only three of seven hunting dogs which had visited a fox's den. Ten days later, a myriad of erythematous papules appeared on their heads, ears, dorsum and dorsal aspect of the tails, and developed progressively into raised firm pale nodules. Although these areas remained the most severely affected, the papules extended progressively to cover their whole bodies.

DISCUSSION

The trombidioid mite *S cynotis* induces a typical nodular dermatitis in dogs living in south and south-west France. Until now, only four species have been described in the genus *Straelensia*, the first specimen being *Straelensia europea* found attached to the eyelid of a young wolf in Bulgaria (Vercammen-Grandjean and Kolebinova 1968). The other species are *Straelensia tiani* (Wen and others 1966), *Straelensia taurica* (Gushcha 1975), both collected from hares, and *Straelensia africana* found on an African mongoose (Vercammen-Grandjean 1971).

The most common trombidioid larval mites infesting domestic animals are attached to the epidermis ('exophytic' localisation) and are identified macroscopically as tiny (0·2 to 0·4 mm), bright red, orange or yellow larvae clustered on small, erythematous papules. These mites include *N autumnalis*, the European harvest mite, which infests most species, *Trombicula sarcina*, an important parasite of sheep in

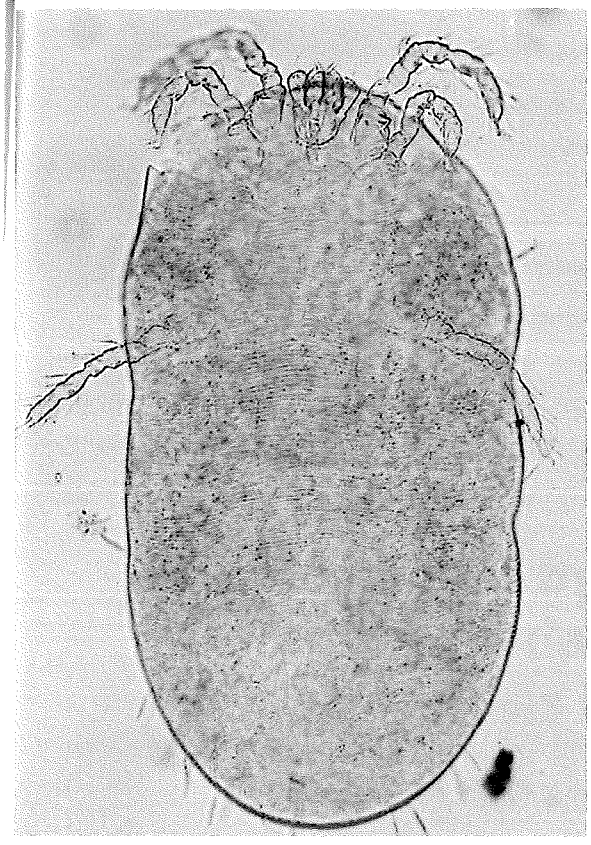

FIG 8: *Straelensia cynotis* from dog 5. The body is covered with thin barbs. Hoyer's medium. x 250

Australia, *Eutrombicula alfreddugesi*, *Euschoengastia latchmani* and *Walchia americana*, which infest cats, dogs and horses (Yager and Scott 1993). A few larval trombidioid mites have been reported to be localised within the thickness of the skin ('endophytic' localisation) inducing a nodular dermatitis in rodents (Brennan and Yunker 1966, Brennan and Reed 1974). They were described at the base of the hair tufts, within a crater-like structure with raised borders and an external opening, which was sometimes occluded by chigger excrement. All these features are also observed in *S cynotis* infestation in dogs.

The examination of the larvae in Hoyer's medium has shown that their mouthparts, in contact with the base of the modified follicle, communicate with the host tissue through a narrow feeding tube or 'stylostome' (Fain and Le Net 2000). The secretion of saliva rich in proteolytic enzymes, the digestion of the host's tissue, and their reabsorption through the stylostome are a common feeding method for the Trombiculidae larvae but has not been reported for larvae of the genus *Straelensia*. The pathognomonic histological changes, pseudoepitheliomatous follicular hyperplasia and perifollicular dermal mucinosis, are probably due to tissue reactions to the larval secretions.

Although trombiculidiasis typically induces a pruritic dermatitis, attributed to an allergic reaction to salivary secretions, *S cynotis* did not induce pruritus and was not associated histologically with an infiltration of eosinophils. The localisation of the larval mite within the hair follicle, its protection by a surrounding amorphous tube and the absence of direct contact with the underlying dermis may play a role in this apparent lack of hypersensitivity. The fact that none of the dogs became reinfested after a complete remission suggests that immunity may develop with time.

Although sprays of fipronil have been reported to be effective in the treatment of *N autumnalis* (Nuttall and others 1998), topical acaricides were not effective against *S cynotis*. A physical protection against topical treatments may be provided by the chigger excrement covering its posterior end. Systemic treatments with avermectins were reported to be effective, indicating that adequate drug concentrations were reached within the ingested lymph and dissolved host tissue. However, the therapeutic responses to systemic acaricides could not be fully evaluated and further studies are needed.

As in most trombidioid diseases, mild to moderate *S cynotis* infestation was not detrimental to the health of the host animal. However, a more severe generalised infestation induced pain to the touch, decreased food intake and fatigue. A massive infestation with *N autumnalis* has been reported to induce temporary hindlimb paresis in two dogs (Prosl and others 1985).

Most trombidioid species are associated with specific habitats, and with environmental factors such as soil types and season. *S cynotis* apparently showed a clear geographical distribution because most of the dogs lived in south and south-west France. Three of the dogs became infested within a fox's den. Furthermore, the available data support the hypothesis of the dens as a natural habitat for *S cynotis*. First, most common trombidioid infestations have a strong seasonal incidence, for example, the European harvest mite induces dermatitis in the late summer and autumn. In contrast, *S cynotis* infestations appear to occur all year round, suggesting that the free-living adult forms of *S cynotis* are protected from climatic variations. Secondly, in other trombidioid infestations, the lesions tend to occur on areas of the body which are close to the ground, for example, the interdigital web in dogs, the caudal pastern in sheep, the pastern in horses, the face in white-tailed deer, and the paws, head and ears in cats (Yager and Scott 1993). In contrast, the lesions in canine straelensiosis occur mainly on the muzzle, scalp and dorsum, a distribution consistent with the infestation occurring during the dog's progress through the den, the infested areas being those in close contact with its walls. The severity of the dermatitis in the three fox terriers may be explained by the high concentration of infesting larval mites, because the dogs' owner reported that the fox's dens had been uninhabited for a long period.

Is canine straelensiosis a new disease or only a newly recognised old disease? It is not known whether changes in fox populations have increased the pressure of *S cynotis* on dogs or whether the diagnosis of this dermatitis is due only to the recent use of skin biopsies in dogs. In the authors' laboratory, the first case was recorded 10 years ago, and the overall annual incidence has not changed.

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Diagnosis by ultrasonography of congestion of the caudal vena cava secondary to thrombosis in 12 cows

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This paper describes the clinical, ultrasonographic, radiographic and postmortem findings in 12 cows with thrombosis of the caudal vena cava. The principal clinical signs were chronic bronchopneumonia and fever in 11 cows; one cow had epistaxis and one cow bled from the mouth; eight cows had anaemia and leucocytosis, and the clotting time for the glutaraldehyde test was markedly decreased in all the cows; in nine of the cows the activity of γ-glutamyltransferase was high, suggesting chronic hepatic congestion. The most important ultrasonographic finding was congestion of the caudal vena cava attributable to thrombosis of the vein. In all the cows the caudal vena cava was round to oval on cross-section, rather than the normal triangular shape. The hepatic, splenic and portal veins were dilated in five, three and one cow, respectively. The results of radiography and endoscopy supported a diagnosis of bronchopneumonia, but there were radiographic changes in the diaphragmatic lung lobes that supported a diagnosis of vena caval disease in only four cows. Postmortem there was a thrombosis of the caudal vena cava in all the cows, and the thrombi were located in the thoracic, subphrenic and abdominal part of the caudal vena cava at the level of the liver in four, one and seven cows, respectively. In three cows, the thrombus was situated where a hepatic abscess had broken into the caudal vena cava, and in one cow it was at the site of a diaphragmatic abscess. In another cow, there was a fistula between the major bronchus of the right diaphragmatic lung lobe and the caudal vena cava where the thrombus was situated. Three cows had liver abscesses that had not broken into the caudal vena cava. There was severe bronchopneumonia in 11 of the cows, some of which also had multiple pulmonary abscesses.

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THE signs of thrombosis of the caudal vena cava in cattle have been described in detail (Rubarth 1960, Stöber 1966, Selman and others 1974, Breeze and others 1976, Jensen and others 1976, Gudmundson and others 1978, Rebhun and others 1980, Ikawa and others 1987, Mills and Pace 1990, Braun and others 1992), and the evidence suggests that a rupture of a hepatic abscess into the caudal vena cava is the most common cause of the condition. The entry into the lungs of emboli from the thrombus results in end-arteritis, multifocal pulmonary abscessation and chronic suppurative bronchopneumonia. This leads to hypertension in the pulmonary arteries and to aneurysms which may rupture and bleed. Occasionally, an abscess forms in the perirenal, subphrenic or thoracic region of the caudal vena cava. Emboli from abscesses in other organs, such as the udder, uterus or hoof, may also cause thrombosis of the caudal vena cava (Smith 1996). In some cases, an abscess cannot be found (Selman and others 1974). Affected animals may die suddenly, but more usually the condition results in chronic disease, predominantly characterised by respiratory signs, but generally accompanied by other, non-specific signs. Affected animals may have an increased respiratory rate, abdominal breathing, an expiratory grunt and abnormal lung sounds. Reports on the incidence of haemoptysis and epistaxis vary, but these signs usually occur in the terminal stages of the disease (Rebhun and others 1980, Mills and Pace 1990).

A definitive diagnosis of thrombosis of the vena cava in vivo is difficult, because the clinical signs are often non-specific. The caudal vena cava can be visualised ultrasonographically only in the 11th and 12th intercostal spaces, but the thrombosis usually occurs further cranially, where the vessel is hidden by the lungs and therefore not accessible to ultrasonographic examination (Braun 1990, Braun and Gerber 1994). In a case report of a cow with a thrombosis of the caudal vena cava, ultrasonography revealed that the caudal vena cava was oval, instead of having its normal triangular shape on cross-section (Braun and others 1992). The aim of this study was to determine whether the shape of the caudal vena