Renal pathology in working dogs in the South African National Defence Force

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ABSTRACT

Urine analysis, serum biochemical profile and a cortical wedge biopsy for histopathological examination was performed on 42 South African National Defence Force (SANDF) dogs from around the country. The only significant finding on urine analysis and serum biochemistry was a relatively large number (16/42) of dogs with elevated serum inorganic phosphate levels. Histopathology revealed that only 9 of the animals had normal kidneys reflected in the wedge biopsy material, with over 50 % of them showing signs of glomerular pathology (primarily mesangioproliferative glomerulonephritis). Other conditions detected histopathologically were haemosiderosis (47 % of animals), focal nephrosis (2.4 %), membranoproliferative glomerulonephritis (2.4 %), focal interstitial nephritis (4.7 %) and acute tubular nephrosis (4.7 %). The lesions observed were of limited distribution and extent; this histopathological finding may account for the absence of significant abnormalities on urine analysis or serum biochemistry profiles. It appears from these results that a large percentage of the SANDF population would be expected to have mild renal lesions, but that these lesions are not severe enough to lead to clinical signs. The findings of this study are similar to those of randomly selected populations of non-military dogs performed in other areas of the world, which also demonstrated an unexpectedly high incidence of histopathological renal pathology in dogs considered healthy. These lesions may well, however, play a role in later life, and it is recommended that military veterinarians maintain an index of suspicion for renal disease, particularly glomerular disease. The aetiology of the histopathological lesions is unknown.

Key words: dog, glomerulonephritis, kidney, renal disease, renal wedge biopsy.

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INTRODUCTION

A retrospective study of renal disease at Onderstepoort Veterinary Academic Hospital indicated that of 735 diagnosed in-patient cases, 43 (5.9 %) had renal disease (F Reyers, Faculty of Veterinary Science, Onderstepoort, pers. comm., 1992). The perception exists in the South African National Defence Force (SANDF) that the incidence of renal disease is higher in working dogs that are kennelled and exposed to other stress factors (SANDF Data 104/10/17).

For many years, the South African Military Health Service of the SANDF has focussed its research on those areas that are of clinical significance in the utilisation of working dogs. For this reason, the perceived high incidence of renal disease is of some significance to the SANDF and worthy of further investigation.

It was decided in principle that a survey of animals around the country would give a good indication of the status of renal disease within SANDF animals, and would form the basis from which further research could be carried out to identify specific causes and predisposing factors should an abnormally high incidence of renal disease be found.

Previous studies have indicated that, for survey purposes, the most useful procedures for the diagnosis of renal disease are urine analysis, serum biochemical profile (urea, creatinine, calcium, inorganic phosphate, sodium, potassium) and renal histopathology of a wedge biopsy[1,3,4,7,9,11,16].

MATERIALS AND METHODS

The model system comprised animals in the service of the SANDF at the time of the trial. A statistician advised that 50 animals of approximately 1000 in the SANDF would be an adequate sample for analysis. A cross-section of SANDF animals from the military facilities in Cape Town (Wingfield Naval Base), Durban (CR Swart Square), Pretoria (Onderstepoort Military Veterinary Clinic) and Bourkes Luck in Mpumalanga (SANDF Dog Centre) was investigated to obtain a representative sample of dogs belonging to the SANDF. Owing to a number of problems, it was not possible to access the full 50 dogs, and finally, 42 dogs were incorporated in the trial.

The experimental animals were randomly selected from the populations served by these clinics using random number tables to select from members of the population that satisfied a number of criteria. All animals had to be in the possession of the SANDF for at least 1 year before joining the model system; have no prior history of renal disease, nor have been treated for any disease in the 6 months immediately before joining the model group, with the exception of routine deworming and vaccination; be clinically healthy on the routine clinical examination performed on all SANDF animals presented at a military veterinary facility.

All animals were housed in standard SANDF kennels, and fed the standard SANDF ration at the prescribed rate used in the SANDF. All animals were standard working animals in the SANDF, and were to be returned to work on completion of the trial. The ages of the animals varied from 2–10 years, and weights from 22–40 kg.

Collection of samples

Animals were clinically examined the day before sample collection. All samples were collected from an animal on the same day and, for the purposes of standardisation, while the animal was under general anaesthesia.

All animals were premedicated with atropine at a dose of 0.05 mg/kg (Atropine 0.5 %, Centaur Laboratories) and acetylpromazine at 0.1 mg/kg (ACP 2 mg/mℓ, Centaur Laboratories). Both drugs were given subcutaneously behind the neck. Thirty minutes thereafter, a 16G teflon catheter (Jelco, Critikon, Johnson & John-

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son) was placed in the cephalic vein, and anaesthesia induced with thiopentone (Intraval, Rhône Poulenc Animal Health) at a dose of 15–25 mg/kg to effect. Animals were then immediately intubated, and placed on maintenance anaesthesia with a mixture of 2 % halothane (Fluothane, ICI South Africa) in oxygen.

Immediately following anaesthesia, a blood sample was collected from a jugular vein into an evacuated, sterile tube with no anticoagulant, for later analysis. After clotting for 1 hour, the blood was centrifuged and the serum separated and refrigerated for later processing. The serum was used to determine urea, creatinine, calcium, sodium, potassium and serum inorganic phosphate levels.

Urine was collected from each animal into a sterile 20-mℓ syringe by cystocentesis. This sample was immediately examined organoleptically, by dipstick (Labstix, Bayer Diagnostics), and, after centrifugation and staining with Sternheimer Malbin stain (Sternheimer Malbin, Kyron Laboratories), the sediment was examined by light microscopy. Dried sediment smears were stained with Cam's Quick (Cam's Quick-Stain, C A Milsch) and examined later.

Once the serum and urine samples had been collected, a polyelectrolyte infusion (Plasmalyte B, Sabax Ltd) was started at 60 mℓ/kg per 24 hr and maintained for the duration of surgery and post-anaesthetic recovery. Fluid therapy was instituted to minimise the development of intra- and post-operative hypotension.

After fluid connection, a thin wedge, cortex biopsy of the left kidney was taken from each animal, using a flank incision[5,10]. The renal biopsy was taken using a standard keyhole technique. The biopsy was taken from the left kidney, as it lies further caudally than the right kidney and is thus more accessible. Following induction of anaesthesia, the animal was placed in right lateral recumbency, and the paralumbar fossa area (approximately 10 × 10 cm) was surgically prepared. A skin incision using a number 10 scalpel blade was made caudal and parallel to the last rib and ventral to the lumbar muscles. The subcutaneous tissues, muscles and fascia were bluntly dissected, using scissors. Retraction of the muscles around the incision allowed visualisation of the caudal pole of the left kidney, which could then be brought up to the incision. A thin wedge biopsy of the cortex (approximately 10 × 5 mm) was taken, using a number 15 scalpel blade. The renal section was placed in 10 % buffered formalin. The renal parenchyma and capsule were sutured with a simple continuous suture pattern using 4/0 catgut (Johnson and Johnson), while the incised edges of the kidney were apposed with digital pressure. Each muscle layer was sutured closed using a simple interrupted pattern with 2/0 nylon (Johnson and Johnson), while the skin was closed in a simple interrupted pattern with 3/0 nylon.

On completion of surgery, a bandage with pressure pad was placed over the surgical site to prevent bleeding. This bandage was removed 24 hours after surgery. All dogs returned to work within 7 to 14 days of the procedure, depending on the requirements of the unit at that time. No post-operative complications were experienced.

After fixation, histopathological samples of wedge biopsies were routinely processed and stained with haematoxylin and eosin.

RESULTS

No significant abnormalities were found on urine analysis, and the only significant abnormality revealed by serum biochemistry concerned the levels of serum inorganic phosphate (SIP). Twenty-five dogs had SIP determinations within the normal reference range, 1 animal had an SIP lower than the normal lower limit (0.78 *vs* a normal lower limit of 0.9), and 16 had elevated SIP levels, the highest being 2.59 (normal upper limit 1.6). The reason for the large number of elevated levels is unclear at present. If these increases were caused by decreased glomerular filtration rates due to withholding water prior to surgery, a rise in urea and/or creatinine would have been expected. It is possible that the elevation was due to delay in sampling and/or dietary factors.

Table 1: **Summarised histopathological findings in 42 dogs.**

	Number of dogs	%
Haemosiderosis 1+	15	35.7
Haemosiderosis 2+	5	11.9
Total	20	47.6
Mesangioproliferative glomerulonephritis 1+	19	45.22
Mesangioproliferative glomerulonephritis 2+	3	11.9
Total	22	52.36
Normal	9	21.42
Focal hydropic/lipid nephrosis	1	2.4
Membranoproliferative glomerulonephritis	1	2.4
Focal interstitial nephritis	2	4.7
Hypertensive vasculopathy	4	9.5
Hydropic degeneration	1	2.4
Acute tubular necrosis	2	4.7

Summarised histopathological findings are presented Table 1 and Fig. 1. Of the 42 animals included in this survey, histopathological examination revealed only 9 (21.42 %) to have no kidney lesions. All the other animals showed some degree of renal pathology, although in many cases the changes were insignificant.

Statistical analysis

The Pearson product-moment coefficient was used to measure the degree or strength of relationship between variables. No correlations were found

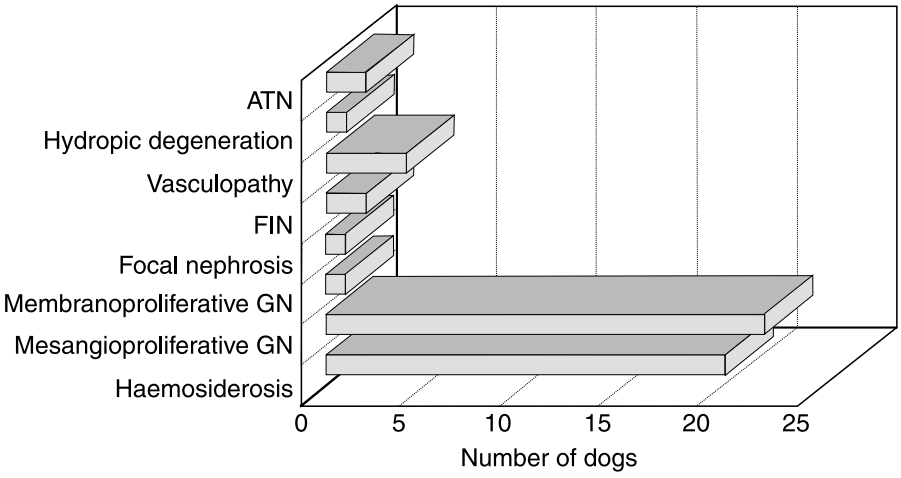

Fig. 1: **Summarised abnormal histopathology.**

between histopathology and any of the other parameters measured. The most surprising finding was that urine protein was not correlated with histopathological findings. It can only be assumed that this was due to the very mild nature of the histopathological findings. The correlations that did exist served largely to confirm that mesangial matrix proliferation was the most common histopathological lesion found. One interesting finding was the correlation between glomerular disease and vascular disease, which serves to confirm the findings of other investigators, who have also found vascular disease in animals suffering from glomerulonephritis[2,16].

DISCUSSION

Many of the renal samples examined in this survey showed more than one type of pathology, with haemosiderosis and mesangioproliferative glomerulonephritis most commonly observed together. These findings were supported by some previous studies, but were at odds with others, as discussed below[2,6,15–17,19,23,25].

Diffuse glomerulonephritis has increased in frequency of occurrence since the early 1970s[17,23,24]. A postulated reason for this is increased vaccination in urbanised populations, which may well play a role in providing antigenic stimulation[18]. Alternatively, increased awareness of the disease and a real increase in incidence have been advanced[24].

Mesangial proliferation is probably the earliest stage of the disease[26], but over the years the use of different classification systems has resulted in some confusion about the true nature of the disease[2,6,15–18,23]. The solution to this problem may have been identified by Vilafranca *et al.*[25] who, in 1994, classified lesions according to the WHO classification. Their findings in a study of 115 dogs were similar in many ways to the findings of this survey.

Two mechanisms have been proposed to describe the development of glomerulonephritis in the dog – either the deposition of antigen-antibody complexes in the capillaries of the glomerulus (a type III hypersensitivity reaction), or the formation of antibodies against the glomerular basement membrane (a type II or cytotoxic reaction)[8,12–14,20,21,23,24]. Of these 2 mechanisms, spontaneous anti-glomerular basement membrane disease has not been diagnosed in the dog[6,12,13,20].

The aetiology of most forms of glomerulonephritis is unknown[20]. It is known, however, that secondary glomerulonephritis arises from inflammatory disease processes in other tissues[13]. It has been postulated that any infection of low pathogenicity may have the potential to cause immune complex glomerulonephritis[20]. Examples of such conditions have been reported[12–14,21]. These are also descriptions of familial glomerulonephropathies[22]. A full discussion of the condition is beyond the scope of this paper.

CONCLUSION

There is a fairly high incidence of renal pathology in SANDF dogs, but not more than reported in other studies. The renal pathology most commonly diagnosed was mesangioproliferative glomerulonephritis, usually in a very mild form. In most cases the degree of the lesion was insignificant, and would have been expected to resolve. The mildness of the cases precluded a diagnosis of glomerulonephritis by any means other than renal biopsy. Obviously this is not practical in the routine clinical setting, and the degree of clinical disease is not significant enough to arouse concern. It is suggested that military veterinarians should be aware of the presence of glomerulonephritis in this population, and consider very carefully whether or not it may play a role in other clinical conditions presented to them. In addition, it becomes clear that standardisation of the histopathological system is necessary, and in this regard it may be best to use the WHO criteria.

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