

Volume of the *ligamentum capitis femoris* in osteoarthritic hip joints of adult dogs

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ABSTRACT

Ventrodorsal pelvic radiographs were made of 32 adult dogs under general anaesthesia. The hip joints were evaluated according to the severity of osteoarthritic changes graded as 0, 1, 2 or 3. The dogs were euthanased, the hip joints opened and the *ligamentum capitis femoris* dissected out *in toto*. The volume of each ligament was determined using a water displacement technique and the mean volume compared to the four radiographic grades of osteoarthritis. There was an inverse correlation ($r = -0.75$) between the mean volume of the *ligamentum capitis femoris* and the increasing severity of osteoarthritis as assessed by radiography. The results confirmed the crucial role of radiography in the clinical evaluation of hip dysplasia and osteoarthritis in the adult dog. Assessment of the volume of the *ligamentum capitis femoris* revealed that it is an important tool for research in canine hip dysplasia and osteoarthritis.

Key words: hip dysplasia, hip joint, *ligamentum capitis femoris*, osteoarthritis, ventrodorsal pelvic radiography.

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INTRODUCTION

Osteoarthritis is an important orthopaedic disease in dogs and human beings. The affected joint exhibits destruction of its articular cartilage, changes in the subchondral bone architecture, capsulitis and synovitis^{11,20}. The disease occurs most frequently in the large, weight bearing joints of medium-sized to large dogs, but may affect any synovial joint. The best example of canine osteoarthritis is that occurring secondary to hip dysplasia².

Joint laxity at a young age, trauma, heritability and genetic factors may modify the onset and progression of osteoarthritis and subsequent enzymatic degradation of the hyaline articular cartilage and synovium as the dog matures. Non-genetic factors, including body size, growth rate, nutrition, dietary anion gap, in-utero endocrine influences and muscle mass are also involved^{13,22}. Despite these factors, the actual cause of canine hip dysplasia and osteoarthritis still remains unknown¹³. Body mass and joint laxity have been reported as signifi-

cant risk factors in 4 large-breed dogs, the risk of having osteoarthritis being 5 times greater in German shepherd dogs than in the other 3 breeds combined²⁴. The probability of having osteoarthritis also increases with age. Mayhew *et al.*¹⁸ confirmed a contemporaneous association between a radiographic caudolateral curvilinear osteophyte on the femoral neck and osteoarthritis. Gustafson¹⁰ described the relationship between trauma and the pathogenesis of osteoarthritis. Mechanical damage to the chondrocytes and synoviocytes causes these cells to release enzymes and cytokines that contribute to the progressive degeneration of the hyaline articular cartilage, as well as the synovial membrane^{9,20}.

Clinical manifestations of canine hip dysplasia may either be asymptomatic, or acute in onset in young puppies. Chronically affected adult dogs may show a wobbly gait, hind-limb lameness, and atrophy of the thigh muscles and prominence of the femoral trochanters. In severe cases there may be alteration in the conformation of the pelvic limbs and reluctance to bear weight, and with progressive disability, the dogs may eventually become recumbent³.

The earliest recognisable change in the affected hip joints is joint laxity. This may

be palpated (Ortolani sign, Barden's lift method) or visualised radiographically². Subsequent radiological changes are those of degenerative joint disease. The order of subsequent changes commences with perichondral osteophyte formation, remodelling of the femoral head and neck, remodelling of the acetabulum and eventually sclerosis of the subchondral bone of the femoral head and acetabulum². Qualitative methods for assessing the severity of hip dysplasia include the subjective hip scores as established by the Orthopedic Foundation for Animals. Quantitative measures of passive hip joint laxity such as the Norberg angle and distractive index derived from newer stress-radiographic diagnostic methods are also often used^{4,22,23}. More recent diagnostic techniques include a dorsolateral subluxation test using radiography^{7,8,16,17}, dynamic ultra-sonography¹, computed tomography⁸ and morphometric assessment of the canine hip joint using the dorsal acetabular rim view and the centre-edge angle¹⁹. A semiquantitative radiographic method of postoperative evaluation of traumatic hip dislocation was described in dogs⁶. Rasmussen *et al.*²¹ used radiographic scoring criteria to evaluate the triple pelvic osteotomy procedure in canine patients with hip dysplasia. There is paucity of information on the use of similar criteria in adult dogs suffering from osteoarthritis of the hip joint.

The integrity and volume of the *ligamentum capitis femoris* has been reported in a colony of Labrador retriever dogs specifically kept for their predisposition to canine hip dysplasia^{14,15}. However, there are no reports on the volume of the *ligamentum capitis femoris* in normal and osteoarthritic hip joints of adult dogs. The present study was designed to determine the relationship between the volume of the *ligamentum capitis femoris* and the radiographic features of normal and osteoarthritic hip joints in adult dogs in Kenya.

MATERIALS AND METHODS

Thirty-two adult German shepherd dogs that were either normal (8) or with hind-limb lameness (24) were used. Nine-

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teen were females and 13 males. The mean body mass was 27.1 kg while the mean age was 9.3 years. General anaesthesia was induced using intravenous injection of pentobarbitone sodium (60 mg/ml, 25 mg per kg Sagatal®, Rhône Merieux, Essex) and standard hip extended ventrodorsal radiography was performed. The severity of osteoarthritic changes within each hip joint was radiographically evaluated and assigned to grades 0, 1, 2 or 3, according to published criteria²¹ (Appendix 1).

The dogs were euthanased using an intravenous injection of pentobarbitone sodium (200 mg/ml, Euthatal® Rhône Merieux, Dublin). The animals that were clinically normal or with grade 1 osteoarthritis included in this part of the study had already been submitted for euthanasia for other medical reasons. The animals with severe osteoarthritis were euthanased due to poor prognosis and advanced age, making them no longer useful as guard dogs. The hip joints were dissected by cutting the muscles from around the pelvis and the femur. A band saw was used to cut the pubis, ilium and ischium to isolate the hip joint, while the femur was disarticulated at the stifle joint. The integrity of the *ligamentum capitis femoris* was determined by visual inspection. The ligament was dissected at its attachment to the acetabulum and at the *fovea capitis* of the femoral head. The volume of the ligament in millilitres was determined by measuring the volume of water displaced in a measuring cylinder as previously described⁵. The mean volume of each *ligamentum capitis femoris* was compared to each grade of osteoarthritis using analysis of variance. A correlation coefficient was used to determine the relationship between the mean volume of each *ligamentum capitis femoris* and the radiographic grade of osteoarthritis of its corresponding hip joint.

RESULTS

An intact *ligamentum capitis femoris* was present in 46 (71.9 %) and absent in 18 (28.1 %) of the hip joints examined in this study. Table 1 presents data on the volume of the *ligamentum capitis femoris* for each radiographic grade. The mean volume of the ligament in hip joints in radiographic grade 0 was higher (0.821 ml) than that of grade 1 (0.654 ml). Although 4 of 7 hip joints in radiographic grade 2 lacked ligaments, the mean volume of the *ligamentum capitis femoris* of hip joints in this group was 0.314 ml. The 13 hip joints in radiographic grade 3 lacked ligaments and the joints had moderate to severe osteoarthritis. The mean volume of the *ligamentum capitis femoris*

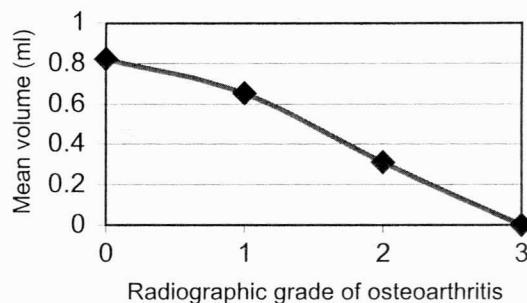


Fig. 1: Relationship between the mean volume (ml) of *ligamentum capitis femoris* and radiographic grades of osteoarthritis of the hip joints in 32 adult German shepherd dogs.

differed highly significantly ($F = 21.6, P < 0.0001$) between groups. However, there was no significant difference between the mean volume of the *ligamentum capitis femoris* in those hip joints that were normal and those with only mild osteoarthritis.

The relationship between the mean volume of the *ligamentum capitis femoris* and the four radiographic grades is illustrated in Fig. 1. There is an inverse correlation ($r = -0.75$) between the mean volume of the ligaments and the severity of osteoarthritis graded radiographically.

DISCUSSION

Canine hip dysplasia has been reported to be the most important cause of osteoarthritis in the hip joint of dogs in Europe and America²². This paper represents the 1st study of radiographic and pathological features of osteoarthritis of hip joints in adult dogs in Kenya.

Joint laxity has been reported to be an important etiological factor in the pathogenesis of canine hip dysplasia¹². Although previous reports have provided data on *ligamentum capitis femoris*, young puppies were used that were specifically kept for their predisposition towards canine hip dysplasia^{14,15}. Ours is the 1st report describing the size of the *ligamentum capitis femoris* in normal and in osteoarthritic hip joints in adult German shepherd dogs.

The mean volume of the *ligamentum*

capitis femoris in normal hip joints (radiographic grade 0) was similar to that of hip joints with mild osteoarthritis in a previous study using young Labrador retriever dogs specifically kept for their genetic predisposition to canine hip dysplasia^{14,15}. Although Lust *et al.*¹⁴ reported an increase in the mean volume of *ligamentum capitis femoris* in hip joints of young puppies with moderate to severe osteoarthritis, the results of our study demonstrated a decrease in the mean volume of the ligament in the hip joints of adult dogs with moderate and severe osteoarthritis. The ligament was small to absent and ruptured in the most severely affected hip joints. This relationship between the mean volume of *ligamentum capitis femoris* and the severity of radiographic features of osteoarthritis in the hip joints of adult dogs has not been reported previously in the veterinary literature.

This study provides additional information on how this important soft tissue structure is affected in hip joints with chronic osteoarthritis. It demonstrates the important role of assessing the volume of the ligament in research of canine hip dysplasia and osteoarthritis in adult dogs. Further, the results confirmed that ventrodorsal pelvic radiography is a valuable diagnostic tool for confirmation of the clinical signs of canine hip dysplasia and osteoarthritis. These data could be used for further epidemiological studies to determine the prevalence of the condition dogs and to evaluate the impact of current measures for evaluating canine hip dysplasia.

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Table 1: Volume of the *ligamentum capitis femoris* (ml) based on radiographic grades for osteoarthritis of the hip joints in 32 adult German shepherd dogs.

Radiographic grade	Volume in ml mean \pm SD (n), range
0	0.821 \pm 0.3462 (33) 0.4–1.5
1	0.654 \pm 0.2544 (11) 0.4–1.0
2	0.314 \pm 0.5551 (7) 0.2–1.5
3	(13) 0

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Appendix 1: Radiographic grading system for assessing the degree of coxofemoral osteoarthritis and canine hip dysplasia¹².

Radiographic grade	Radiographic features
Grade 0	C-shaped acetabulum, dorsal rim rounded with a distinct femoral neck.
Grade 1	Shallow acetabulum or marked dorsal rim attenuation, moderately osteophytic acetabular margin, rounded femoral head, minimal osteophytes on the femoral neck.
Grade 2	Shallow acetabulum, or marked dorsal rim attenuation, moderately osteophytic acetabular margin, flattened femoral head, shortened femoral neck with osteophytes.
Grade 3	Flat acetabulum, severely osteophytic acetabular margin, marked flattened or irregular femoral head, severely shortened femoral neck with osteophytes.

Diseases of free-ranging chickens in the Qwa-Qwa District of the northeastern Free State province of South Africa

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ABSTRACT

A total of 177 free-ranging chickens from 19 Qwa-Qwa villages were bled from wing veins over a period of 6 months (June–November 2000). Serological tests indicated that 5 % of chickens tested had been exposed to Newcastle disease, 43 % to infectious bronchitis and 63 % to *Mycoplasma gallisepticum* infection. McMaster and Visser sieve techniques were used to determine helminth and coccidia from pooled fresh faecal samples. Helminths isolated in 37 % of the villages investigated were *Heterakis*, *Ascaridia* and *Capillaria* species. *Eimeria* species were also isolated in 32 % of the villages investigated. The red fowl mite (*Dermanyssus gallinae*) was isolated from some of the birds and their nests. Data from a questionnaire survey indicated that all farmers interviewed had never received any technical support and that their chickens had never been vaccinated against any avian diseases. Only 10.5 % of the owners interviewed had scientific knowledge on poultry diseases. There is an urgent need for the government to support free-ranging poultry farmers by providing subsidised vaccinations and technical support in order to develop and stimulate economic development in impoverished rural areas of South Africa.

Key words: avian helminths, free-ranging chickens, infectious bronchitis, *Mycoplasma gallisepticum*, Newcastle disease.

Thekiso M M O, Mbat P A, Bisschop S P R Diseases of free-ranging chickens in the Qwa-Qwa District of the northeastern Free State province of South Africa. *Journal of the South African Veterinary Association* (2003) 74(1): 14–16 (En.). Parasitology Research Programme, School of Life Sciences, University of the North – Qwa-Qwa Campus, Private Bag X13, Phuthaditjhaba, 9866 South Africa.

INTRODUCTION

The Qwa-Qwa district of the northeastern Free State province of South Africa has many villages where Basotho people still live traditional lifestyles. They own and breed various domestic animals such as cattle, sheep, goats, pigs and poultry. There are free-ranging village chickens (*Gallus gallus domesticus*) in Qwa-Qwa that are provided with night shelters made from inexpensive local materials such as wire mesh and old corrugated iron. Nests are made from dried grass and stones. These chickens serve as an important source of animal protein in the form of meat and eggs to the rural poor in most parts of Africa¹.

A major problem for village chicken production is a single infectious disease, Newcastle disease². It is caused by a group of closely related viruses that form the

avian paramyxovirus type 1 (PMV-1) serotype. Infectious bronchitis is a disease of chickens caused by a coronavirus. It is a highly infectious and contagious respiratory disease of chickens². The infection is of greatest economic importance due to its adverse effect on egg production and egg quality in layers and is a cause of respiratory tract infection in broilers. *Mycoplasma gallisepticum* infection is commonly designated as a chronic respiratory disease of chickens and infectious sinusitis of turkeys.

The most common group of internal parasites found in poultry are intestinal nematodes and there are 3 genera that are of significance, *Capillaria*, *Heterakis* and *Ascaridia*⁵. Of the protozoa that affect chickens, the most important are coccidia of the genus *Eimeria*, which causes coccidiosis. There are numerous external parasites, including lice, mites, ticks, fleas and flies¹. These parasites cause skin irritation and consequent unthriftiness on their host and as most are bloodsuckers, they may also cause anaemia in heavy infestations.

There is no documented information on poultry diseases of economic importance

occurring in the Qwa-Qwa district. The aim of this study was therefore to identify these diseases with special reference to Newcastle disease, infectious bronchitis and *M. gallisepticum* infection. The study also identified endoparasites such as helminths and coccidia, and ectoparasites infesting free-ranging poultry in Qwa-Qwa. A questionnaire survey was conducted with the primary purpose of determining the knowledge and perceptions of village farmers with regard to poultry diseases, vaccinations, technical support and management of backyard chickens.

MATERIALS AND METHODS

Study area

Qwa-Qwa lies in the northeastern Free State (28°50'E, 28°35'S) and is 4470 km² in extent¹. It lies 1600 m above sea level, with a mean annual rainfall of 800 mm.

Serological assays

A total of 177 blood samples was collected from approximately 10 chickens per village from a total of 19 villages. Blood samples were collected from the wing veins of chickens with a sterile 21G needle into vacutainers. Samples were stored overnight at 25 °C in a dry incubator and serum harvested into cryogenic vials using 500 µl micropipettes. A rapid plate agglutination test for *M. gallisepticum* was conducted with the fresh serum using Nobilis MG antigen (Intervet South Africa) in the Parasitology laboratory of the University of the North's Qwa-Qwa campus. The remaining serum was stored at –35 °C and later used for haemagglutination inhibition test for Newcastle disease (Poultry Reference Laboratory Standard Operational Procedures 2000) and ELISA for infectious bronchitis (Delta Bioproducts Procedures 2000) which were conducted in the Poultry Reference Laboratory, Faculty of Veterinary Science, University of Pretoria.

Collection and isolation of parasites

Pooled fresh faecal samples were collected from the poultry houses and placed in plastic bags. They were then

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