Topics in Compan An Med ∎ (2015) ∎∎∎–∎∎∎

Topical Review

Lumbosacral Transitional Vertebrae, Canine Hip Dysplasia, and Sacroiliac Joint Degenerative Changes on Ventrodorsal Radiographs of the Pelvis in Police Working German Shepherd Dogs

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Keywords:
lumbosacral transitional vertebrae
canine hip dysplasia
sacroiliac joint degenerative changes
working dogs

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Lumbosacral transitional vertebrae (LTV) frequently occur in German shepherd dogs. The aim of the study was to evaluate the prevalence and interdependence between LTV and canine hip dysplasia (CHD) as well as sacroiliac joint degenerative changes visualized on ventrodorsal radiographs of the pelvis in both working and companion German shepherd dogs. The presence of LTV was found in 12% of working dogs and in 33% of companion dogs. Similar incidence of hip dysplasia in both the groups was found. It has been shown that dogs with LTV have a higher frequency of severe CHD. A higher percentage of sacroiliac joint degenerative changes was observed in dogs with no signs of LTV and in working dogs.

Introduction

The term "lumbosacral transitional vertebrae" (LTV) means the abnormally formed vertebra between the last normal lumbar vertebra and the first normal sacral vertebra.[1] This disorder is classified as congenital and has morphologic characteristics of both lumbar and sacral vertebrae.[1,2] A hereditary predisposition to LTV is also suggested.[2-4] LTV may be responsible for weakening of the sacroiliac attachment and lead to premature intervertebral disk degeneration in the lumbosacral segment as well as occurrence of cauda equina syndrome.[2-5] Moreover, asymmetric transitional vertebrae may hinder the correct positioning of the dog for hip dysplasia evaluation.[2,6]

Canine hip dysplasia (CHD) is considered to be a heritable developmental disease, which leads to the development of osteoarthritis.[7-11] Studies by Smith et al.[12] revealed that, when compared with rottweilers, Labrador retrievers, and golden retrievers, the risk of the development of degenerative joint disease associated with hip dysplasia in German shepherd dogs is almost 5 times higher. Both CHD and LTV were often described in German shepherd dogs.[3,8,10,13-15] It is postulated to eliminate breeding of affected individuals and exclude them from expensive long-term trainings.[2,8,14,16]

The problem of sacroiliac joint degenerative changes in dogs is mentioned less frequently. Currently, it is suggested that sacroiliac joint disease may be responsible for pain at the gluteal region of the proximal thigh.[17]

The aim of the retrospective studies was to evaluate the prevalence and interdependence between LTV and hip dysplasia as well as sacroiliac joint degenerative changes visible on ventrodorsal radiographs in both working and companion German shepherd dogs.

Material and methods

The retrospective studies have been conducted based on the pelvic radiographs of 205 German shepherd dogs in order to confirm or exclude hip dysplasia. Collected data came from the Faculty of Veterinary Medicine at the University of Life Sciences in Lublin. The dogs were divided into 2 groups: (A) police working dogs that were subjected to physical agility tests and radiographic examinations of hip joints and (B) companion dogs, the control group, which never underwent physical agility tests.

For the radiographic examination, all animals were sedated intramuscularly with a combination of 2 mg/kg of xylazine (Sedazin, Biowet Puławy Sp. z o.o., Puławy, Poland), 0.25 mg/kg of diazepam (Relanium, Warszawskie Zakłady Farmaceutyczne, Polfa S.A., Warszawa, Poland), and 0.05 mg/kg of atropine sulfate (Atropinum-Sulfuricum, WZF Warszawskie Zakłady Farmaceutyczne, Polfa S.A., Warszawa, Poland).

Ventrodorsal radiographs of the pelvis with pelvic limbs extended in accordance with the Orthopedic Foundation for Animals and Federal Cynologique Internationale regulations were performed.[18] The following 3 quantitative traits were evaluated: LTV (divided into types with particular emphasis on the type of transverse process: symmetric or asymmetric), hip dysplasia (each joint was assessed separately), as well as degenerative changes of the sacroiliac joints, separately for each joint (right and left), recording their presence (1) or absence (0) in the binary system.

http://dx.doi.org/10.1053/j.tcam.2015.02.005
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The LTV was considered the one that had at least one of the morphologic features visible on the ventrodorsal radiographs[3]: the spinous process of the first sacral vertebra separated from the median sacra crest, distinct morphologic changes in the transverse processes of the presacral vertebra or contact of at least one of these processes with the iliac bone, rotation of the presacral vertebra or the sacral bone over their long axes, or the lack of symmetry in the length and position of the sacroiliac attachment. Based on the shape and their attachment to the ilium, the transverse processes of LTV were divided into 3 types. Type 1 (lumbar type) is not attached to the ilium or sacral bone (Fig 1). Type 2 (intermediate type) is partially attached to the ilium or sacral bone, but the tip remains always free (Fig 2). Type 3 (sacral type) has characteristics of a sacral wing: it has a broad attachment to the ilium and often to the wing of the sacrum and does not have a free tip (Fig 1). It is considered that LTV is symmetric if it has the same type of transverse processes (1/1, 2/2, and 3/3), whereas asymmetric LTV has a different type of transverse processes, for example, type 1 on the right side and type 3 on the left side (1/3).[3,16]

Hip dysplasia was evaluated in accordance with regulations of the Federal Cynologique Internationale.[18] The CHD score includes A (no signs of hip dysplasia) (Fig 3), B (near-normal hip joints) (Fig 4) (free of CHD), and C (mild hip dysplasia) (Fig. 5), D (moderate hip dysplasia), E (severely affected by CHD) (Fig 6).

Features indicating sacroiliac joint degenerative changes visible in a ventrodorsal radiograph of pelvis[7,17] included osteophyte formation, calcification of the sacroiliac ligaments or sclerosis at the site of their insertion, and ankylosis or increased opacity of the synovial joint (Fig 7).

To evaluate the correlation between selected changes in the skeletal system in working and companion German shepherd dogs and exposure of facilitating factors, the odds ratio (OR) parameter was used. Counted interactions created the data table with dimensions of 2×2, based on which Mantel-Haenszel statistics and chi-square of homogeneity were calculated ($P < 0.05$ considered statistically significant). Statistical calculations were performed using the R Statistical Software with the "EPIR" module.

Results

The working dogs group (group A) included 99 German shepherd dogs (10 females and 89 males) aged 1.2-12 years (an average age of 5 years). The companion animals group (group B) included 106 German shepherd dogs (14 females and 94 males) aged from 0.5-11 years (an average age of 2.6 years).

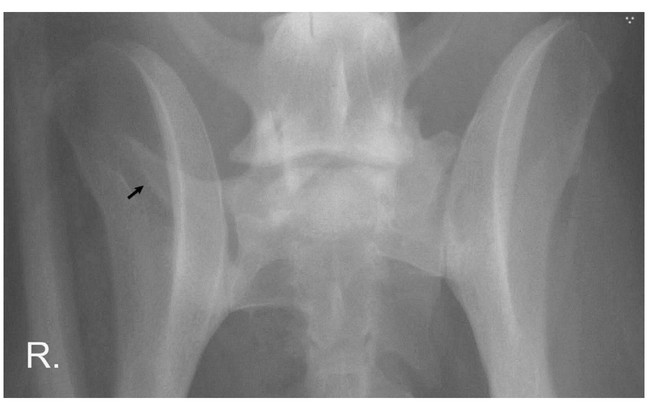

Fig. 1. Ventrodorsal projection of the lumbosacral area in the dog with the pelvic limb extended. There is asymmetric LTV (1/3). The transverse process on the right is not attached to the ilium bone (black arrow), whereas the one on the left is fully attached to the ilium and the sacrum.

Fig. 2. Ventrodorsal projection of the lumbosacral area in the dog with the pelvic limb extended. There is symmetric LTV (2/2): both transverse processes are partially attached to the ilium, whereas their tips remain free (small arrows).

Imaging findings on ventrodorsal radiographs of the pelvis in the working German shepherd dogs and the control dogs are shown in Table 1.

Prevalence of morphologic traits in working German shepherd dogs and control dogs is shown in Table 2.

LTV was found in 47 (22.9%) animals. In the German shepherd dogs from the group of companion animals, LTV was more frequent. The risk of its occurrence was more than 3 times greater

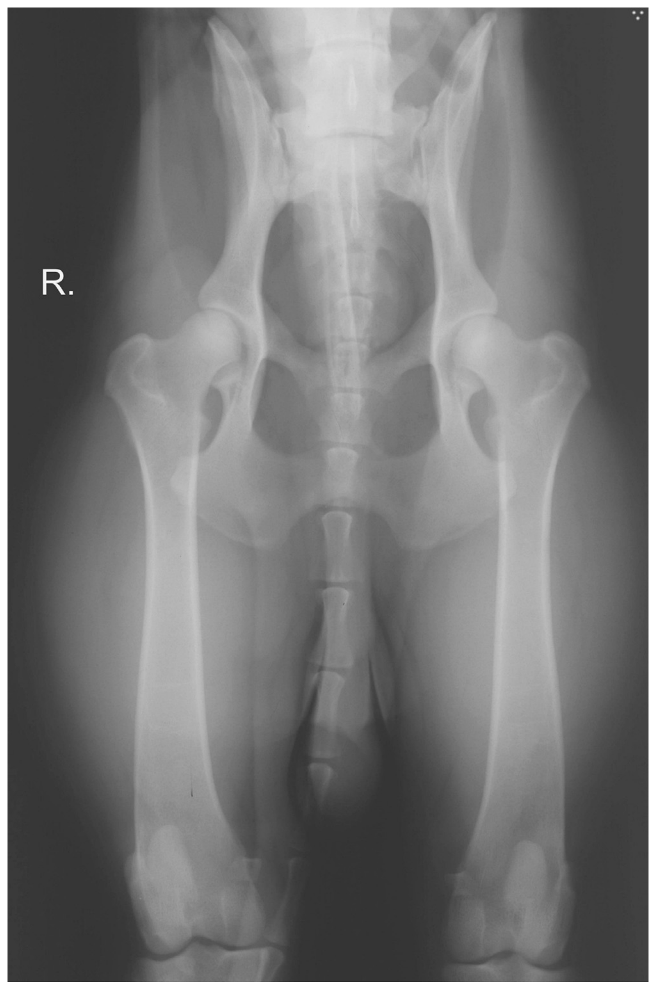

Fig. 3. A ventrodorsal hip-extended radiograph in the dog with no signs of dysplasia (CHD A) in both the joints. The femoral heads and the acetabulums are congruent, the joint spaces are narrow and even, and the craniolateral rims are sharp and slightly rounded. The acetabular angles according to Norberg are approximately 105°.