Vol 34, Issue 6, December 2020

VETERINARIA

Classification and incidence of lumbosacral transitional vertebrae in dogs in Italy

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Introduction: The lumbosacral Transitional Vertebra (VT) is a malformed vertebrae classified on the basis of the morphology of the transverse processes and their relationship with the ileum. The prevalence of VT in dogs, reported in the literature, varies both by breed and by country of study.
Aims of the study: Describe the classification of VT, identify a correlation between VT, the degree of HD and sex and evaluate the incidence of VT in breeds officially diagnosed for HD at the Animal Health Foundation (FSA).
Materials and methods: 15864 ventro-dorsal radiographs sent to the FSA from 2008 to 2017 were analyzed. The cases of VT were classified according to the 4 classifications described in the literature. The incidence was assessed for each breed. Sex and HD grade of each case of VT were recorded.
Results: VT was found in 174 cases in 42 races. The breeds with the highest prevalence were Epagneul Breton (7.08), Hanoverian Hound (4.87%) and English Setter (4.76%). A statistically significant difference was found between dogs with VT and without in relation to the presence of HD. No correlation with sex was found.
Conclusions: There was no correlation between sex and the incidence of VT. Asymmetric VT predisposes to asymmetric HD. The classification that considers the symmetry in its entirety may be the most functional.

INTRODUCTION

Lumbosacral transitional vertebrae (LSTV) are malformed vertebrae located between the last normal lumbar vertebra and the first normal sacral vertebra. It is a congenital anomaly, hereditary in nature,[2,3] with features typical of both lumbar and sacral vertebrae. Over the past fifteen years this anomaly has been classified using four different methods.

In 2006, M.A. Flückiger *et al.* classified LSTV based on the morphology of the transverse processes and their relationship to the ileum, assessed with a ventrodorsal radiograph of the pelvis. LSTV was subdivided into 3 categories: type 1, or lumbar, with the transverse processes

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Received: 06/05/2020 - Accepted: 21/11/2020

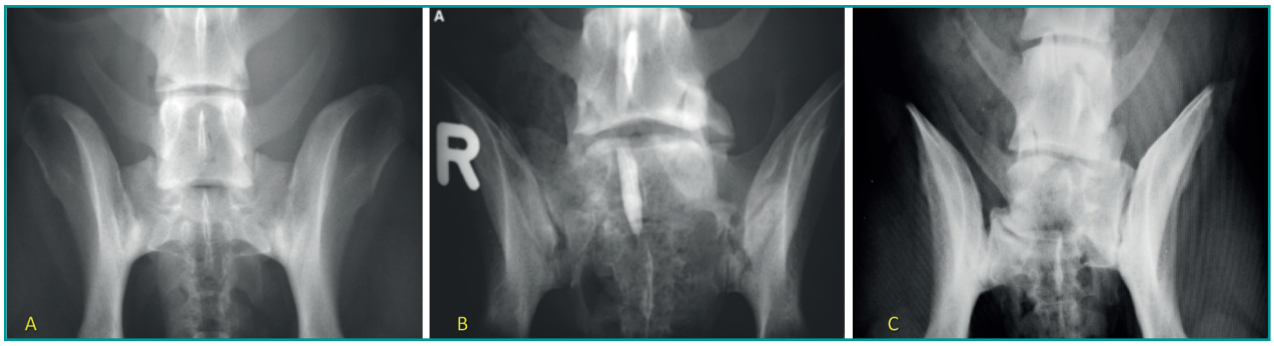

Figure 1 - Lumbosacral transitional vertebra of lumbar type (A); intermediate type (B) and sacral type (C). (M.A. Flückiger, 2006).

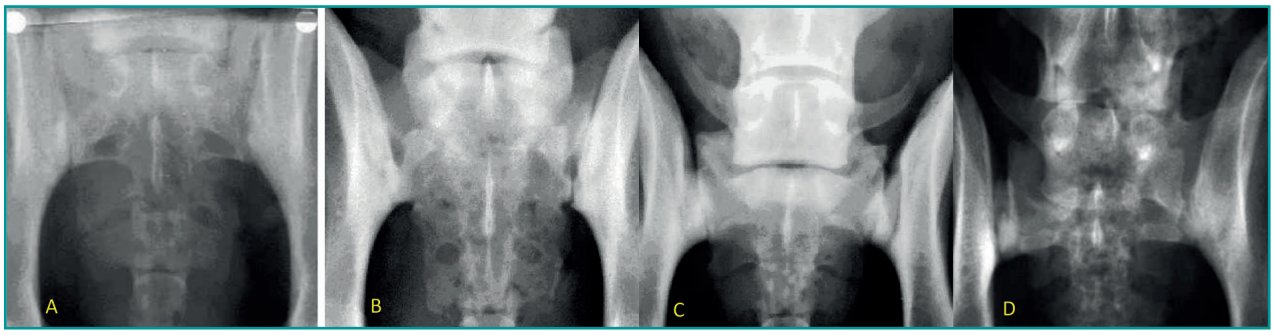

Figure 2 - Lumbosacral transitional vertebra of type 2 (A); type 3 (B); type 4 (C) and type 5 (D). (A. Wigger, 2009).

Figure 3 - Type 1 LSTV with separation of the median sacral crest (A), type 2 LSTV abnormal but symmetric (B) and type 3 totally asymmetric (C). (M.A. Flückiger, 2009).

typical of a lumbar vertebra; type 2, or intermediate, with the transverse processes superimposed on the ileum, but with a free apex and a shorter and wider base than in type 1; type 3, with the morphology typical of a sacral wing (Figure 1). With this classification, 6 different classes can be distinguished based on the morphology of the right and left transverse process (1/1, 1/2, 1/3 2/2, 2/3, 3/3). Symmetric LSTV has the same type on both sides, whereas asymmetric vertebrae have different types on the two sides.[1] If the difference in length of the contact point between the transverse process and the wing of the ileum on the two sides is of more than 2 millimetres, the LSTV is classified as asymmetric.[1-2]

A second classification, proposed by A. Wigger *et al.* in 2009, considers the separation of the spinous process of the first sacral vertebra from the median crest, the symmetry of the transverse processes and the symmetry of the LSTV *in toto*. Type 1 is a normal vertebra; type 2 has the separation of the spinous process of the first sacral vertebra from the median crest and consequently the presence of 8 lumbar vertebrae (L8); type 3 has abnormal but symmetric transverse processes; in type 4 they are asymmetric; in type 5 the vertebra is totally asymmetric[3] (Figure 2).

The third classification, by M.A. Flückiger *et al.* in 2009, is based on the presence of the separation of the spin-

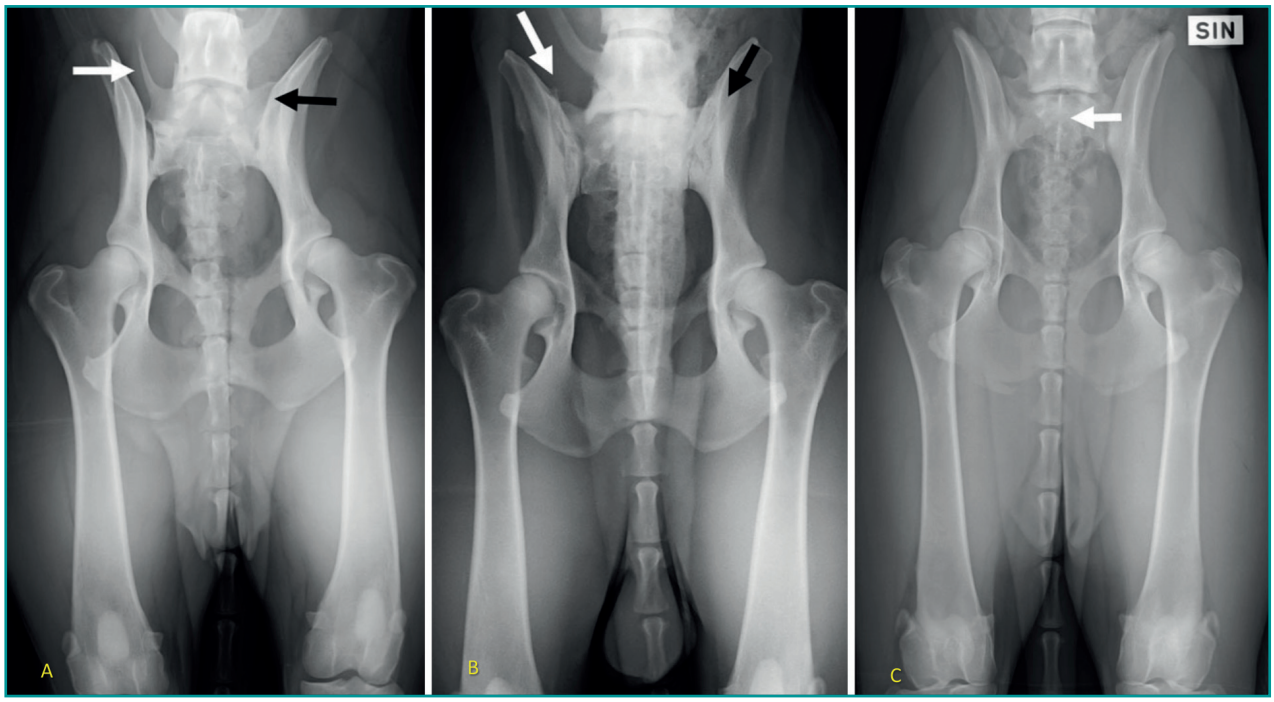

Figure 4 - LSTV type 1 on one side and type 3 on the other (A); type 2 and type 3 (B) and type 4 (C). (A.K. Lappalainen, 2012).

ous process of S1 from the median crest and the symmetry of the LSTV *in toto*. There is consequently a type 1 in which the median crest is separated (L8), a type 2 with an abnormal but symmetric vertebra and a type 3 in which the vertebra is totally asymmetric[4] (Figure 3).

A fourth classification was proposed by Lappalainen *et al.* in 2012, which considered the separation of the spinous process of the first sacral vertebra from the median crest and the morphology of the transverse process. In type 1 the transverse processes have the typical morphology of a lumbar vertebra; in type 2 they are superimposed on the ileum, but the apex is free; in type 3 they have the appearance of a sacral wing; and in type 4 there is separation of the median crest (L8)[5] (Figure 4). Types 1, 2 and 3 are then further subdivided into symmetric and asymmetric.

The prevalence of LSTV varies according to the breed and country in which the study was carried out. According to the literature, the German Shepherd is the breed with the highest predisposition, with a prevalence ranging between 5.7% and 44%.[2-3-5-7-8-9] In Italy, however, no historical epidemiological data are available on this malformation.

It is well documented that LSTV may predispose to the development of the Cauda Equina Syndrome (CES) and hence to its associated clinical signs.[11] In particular, the presence of LSTV increases by almost eight times the likelihood of developing CES. In addition, the lumbosacral syndrome occurs earlier in life compared to subjects without LSTV.

Lumbosacral transitional vertebrae (LSTV) are a congenital anomaly with features typical of both lumbar and sacral vertebrae. The anomalies have been classified using 4 methods.

AIMS OF THE STUDY

The aims of this study were to describe the classification of lumbosacral transitional vertebrae (LSTV), to identify a correlation between LSTV and the degree of hip dysplasia (HD) and gender, and to assess the incidence of LSTV in the various dog breeds in Italy that underwent an official screening assessment for HD at the Fondazione Salute Animale (FSA).

MATERIALS AND METHODS

An analysis was made of the ventrodorsal pelvic radiographs sent to the Fondazione Salute Animale between 2008 and 2017; LSTV cases were classified based on the 4 classification systems described in the literature.

For ease of calculation, the LSTV types from the classification of Flückiger *et al.* of 2006 and Lappalainen *et al.* of 2012 were renamed: independently of the side, the intermediate-lumbar type was called type 1, the intermediate-sacral type 2, the lumbar-sacral type 3, the lumbar-lumbar type 4, the intermediate-intermediate type 5, the sacral-sacral type 6 and the separation of the spinous process of the first sacral vertebra from the median crest was identified as type 7.

Table 1 - Breeds and number of subjects officially screened for hip dysplasia. In yellow the breeds in which cases of LSTV were identified, in blue the breeds with no cases of LSTV.

BREED	SUBJECTS (%)	BREED	SUBJECTS (%)
American Akita	30 (0.19%)	Gordon Setter	14 (0.08%)
Airedale Terrier	10 (0.06%)	Greater Swiss Mountain Dog	74 (0.46%)
Akita Inu	359 (2.20%)	Griffon	2 (0.01%)
Great Dane	49 (0.30%)	Groenendael	51 (0.32%)
Alaskan Malamute	65 (0.41%)	Hovawart	208 (1.31%)
American Cocker Spaniel	8 (0.04%)	Irish Soft Coated Wheaten Terrier	4 (0.02%)
American Staffordshire Terrier	92 (0.58%)	Jack Russel Terrier	10 (0.06%)
Australian Cattle Dog	49 (0.30%)	Labrador Retriever	2688 (16.95%)
Australian Kelpie	30 (0.19%)	Laekenois	1 (0.005%)
Poodle	40 (0.25%)	Lagotto Romagnolo	173 (1.10%)
Basenji	4 (0.02%)	Landseer	7 (0.04%)
Basset hound	29 (0.18%)	Leonberger	142 (0.90%)
Bayerischer Gebirgsschweisshund	64 (0.40%)	Afghan Hound	2 (0.01%)
Beagle	2 (0.01%)	Czechoslovakian Wolfdog	641(4.05%)
Bearded Collie	9 (0.05%)	Malinois	165 (1.05%)
Beauceron	66 (0.41%)	Manchester Terrier	1 (0.005%)
Black and Tan Coonhound	2 (0.01%)	Pyrenean Mastiff	7 (0.04%)
Bloodhound	2 (0.01%)	Nova Scotia Duck Tolling Retriever	18 (0.11%)
Bobtail	33 (0.21%)	Parson Russel Terrier	2 (0.01%)
Boerboel	1 (0.005%)	Australian Shepherd	381 (2.40%)
Border Collie	1210 (7.63%)	Bergamasco Shepherd	12 (0.07%)
Bernese Shepherd	1201 (7.60%)	Caucasian Shepherd	9 (0.06%)
Appenzeller Sennenhund	13(0.08%)	Kangal Shepherd	5 (0.03%)
Entlebucher Mountain Dog	3 (0.02%)	Central Asian Shepherd	8 (0.04%)
Bouvier des Flandres	5 (0.03%)	Picardy Shepherd	2 (0.01%)
Boxer	170 (1.07%)	Maremmano-Abruzzese Sheepdog	72 (0.45%)
Bracco Italiano	17 (0.12%)	Dutch Shepherd	16 (0.10%)
Braque d'Auvergne	5 (0.03%)	Shetland Sheepdog	12 (0.07%)
Broholmer	1(0.005%)	Swiss Shepherd	144 (0.91%)
Bull Terrier	16 (0.10%)	German Shepherd	1442 (9.10%)
American Bulldog	4 (0.02%)	English Pointer	19 (0.15%)
French Bulldog	1(0.005%)	Polski Owczarek Nizinny	1 (0.005%)
English Bulldog	2 (0.01%)	Rhodesian Ridgeback	145 (0.9%)
Bullmastiff	76 (0.47%)	Riesenshnauzer	53 (0.33%)
Cane Corso	309 (1.95%)	Rottweiler	630 (3.97%)
German Pointer	47 (0.29%)	Rough Collie	7 (0.04%)
Saarloos Wolfdog	6 (0.04%)	Samoyed	47 (0.29%)
Pyrenean Mountain Dog	5 (0.03%)	St. Bernard	40 (0.25%)
Karelian Bear Dog	3 (0.02%)	Schnauzer	35 (0.22%)
Canadian Eskimo Dog	1 (0.005%)	Scotch Collie	138 (0.90%)
Cao de Agua	14 (0.08%)	Hannover Hound	41 (0.25%)
Pug	1 (0.005%)	English Setter	63 (0.39%)
Cavalier King Charles Spaniel	5 (0.03%)	Irish Setter	35 (0.22%)
Chesapeake Bay Retriever	7 (0.04%)	Shapendoes	2 (0.01%)
Chinese Shar-Pei	16 (0.10%)	Shiba Inu	114 (0.72%)
Chow Chow	20 (0.12%)	Shikoku	5 (0.03%)
Cocker Spaniel	260 (1.63%)	Siberian Husky	87 (0.54%)
Dalmatian	19 (0.15%)	Smooth Collie	1 (0.005%)
Doberman Pinscher	399 (2.50%)	Spinone Italiano	19 (0.15%)
Dogo Argentino	25 (0.16%)	English Springer Spaniel	18 (0.14%)
Dogue de Bordeaux	126 (0.80%)	Staffordshire Bullterrier	21 (0.13%)
Dutch Decoy Dog	2 (0.01%)	Newfoundland	171 (1.10%)
Mastiff	16 (0.10%)	Tervuren	32 (0.20%)
Epagneul Breton	127 (0.80%)	Tibetan Terrier	45 (0.28%)
Eurasier	5 (0.03%)	Vizsla	15 (0.09%)
Flat Coated Retriever	82 (0.52%)	Weimaraner	463 (2.95%)
German Pinscher	3 (0.02%)	Welsh Corgi	12 (0.07%)
Golden Retriever	2091 (13.20%)	Welsh Springer Spaniel	1 (0.005%)
		Total	15,864 (100%)

All the radiographs were evaluated by two official FSA readers and then classified by one of the authors (LM). The incidence was evaluated for each breed and was considered significant only in breeds with more than 25 dogs officially screened for hip dysplasia. In addition, for each case of LSTV the gender and HD grade were recorded and the correlation was investigated using the chi-squared test. A p-value <0.05 was considered statistically significant. The distribution of the various HD grades related to the different types of LSTV was also calculated.

The prevalence of LSTV varies according to the breed and country in which the study was carried out. The German Shepherd is apparently the breed with the highest predisposition, with a prevalence ranging between 5.7% and 44%.

RESULTS

A total of 15,864 ventrodorsal pelvic radiographs were analysed regarding 117 different dog breeds, listed in Table 1 with the breeds in alphabetical order and the respective number of dogs for each breed.

The population consisted of 8,540 (53.84%) females and 7,324 (46.16%) males.

LSTV was not found in 72 breeds (15,690 dogs), including the Akita Inu, Scotch Collie and Hovawart; LSTV was instead detected in 174 subjects belonging to 42 different breeds, of which 30 German Shepherds (17.24%), 22 Golden Retrievers (12.64%), 14 Border Collies (8.04%) and 13 Labrador Retrievers (7.47%) (Table 2).

Among the different dog breeds, the prevalence of LSTV varied from 0% to 100% (Table 2). However, in the Pug, in which the prevalence was of 100%, the number of dogs presented for an official HD screening at the FSA was of only one dog and hence the prevalence for this breed was not statistically considered, as for other breeds with less than 25 dogs screened: Shapendoes, Anatolian Shepherd, American Cocker, Chow Chow, Nova Scotia Duck Tolling Retriever, Spinone Italiano and Shar Pei, of which only 2, 5, 8, 20, 18, 19 and 16 dogs were evaluated, respectively. In this study, the mean prevalence of LSTV in breeds with more than 25 dogs screened for HD was of 2.08%.

A statistically significant difference ($P<0.05$) was found between dogs with and without LSTV in relation to the presence of HD. In the group with LSTV subjects with grade A hip dysplasia were 35% of the population, while in dogs without LSTV the same grade of HD was found in 49.5% of the dogs (Table 3). The incidence of severe

Table 2 - Breeds and number of cases of LSTV with relative prevalence. In blue the breeds with more than 25 dogs officially screened for hip dysplasia, in yellow the breeds with less than 25 dogs screened.

Breed	Dogs With Lstv	Prevalence
Epagneul Breton	9	7.08%
Hannover Hound	2	4.87%
English Setter	3	4.76%
Dogo Argentino	1	4.0%
Groenendael	2	3.92%
Leonberger	5	3.52%
Rhodesian Ridgeback	5	3.44%
Greater Swiss Mountain Dog	2	3.12%
Irish Setter	1	2.85%
Swiss Shepherd	4	2.77%
Siberian Husky	2	2.29%
Samoyed	1	2.12%
German Shepherd	30	2.08%
Great Dane	1	2.04%
Shiba Inu	2	1.75%
Rotweiler	10	1.58%
Dogue de Bordeaux	2	1.58%
Australian Cattle Dog	6	1.57%
Alaskan Malamute	1	1.53%
Beauceron	1	1.51%
Maremmano-Abruzzese Sheepdog	1	1.38%
Flat Coated Retriever	1	1.21%
Boxer	2	1.17%
Border Collie	14	1.15%
Lagotto Romagnolo	2	1.15%
Golden Retriever	22	1.05%
Weimaraner	4	0.86%
Dobermann	3	0.75%
Bernese Shepherd	7	0.58%
Labrador Retriever	13	0.48%
Cocker Spaniel	1	0.38%
Cane Corso	1	0.32%
Czechoslovakian Wolfdog	1	0.15%
Chow Chow	1	5.0%
Spinone Italiano	1	5.26%
Nova Scotia Duck Tolling Retriever	2	11.1%
Shar Pei	1	6.25%
American Cocker Spaniel	1	12.5%
Kangal Shepherd	1	12.5%
Schapendoes	1	50.0%
Pug	1	100.0%

Table 3 - Distribution of cases with and without LSTV within the 5 grades of hip dysplasia.					
	HD A	HD B	HD C	HD D	HD E
LSTV	61 (35.0%)	77 (44.3%)	19 (10.9%)	7 (4.0%)	10 (5.8%)
NO LSTV	7758 (49.5%)	5379 (34.3%)	1719 (10.9%)	556 (3.6%)	278 (1.7%)

Table 4a - Incidence of hip dysplasia by different type of LSTV according to the classification proposed by Flückiger et al. in 2006.						
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
HD	45 (60.0%)	20 (66.6%)	12 (63.1%)	4 (80%)	28 (66.6%)	3 (100%)

Table 4b - Incidence of hip dysplasia by different type of LSTV according to the classification proposed by Wigger et al. in 2009.					
	Type 1	Type 2	Type 3	Type 4	Type 5
HD	0 (0%)	1 (100%)	9 (69%)	92 (63.0%)	10 (76.9%)

Table 4c - Incidence of hip dysplasia by different type of LSTV according to the classification proposed by Flückiger et al. in 2009			
	Type 1	Type 2	Type 3
HD	1 (100%)	10 (84.5%)	102 (69.94%)

Table 4d - Incidence of hip dysplasia by different type of LSTV according to the classification proposed by Lappalainen et al. in 2012.							
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7
HD	45 (60.0%)	20 (66.6%)	12 (63.1%)	4 (80%)	28 (66.6%)	2 (100%)	1 (100%)

grades of hip dysplasia (D and E) was significantly higher in dogs with LSTV compared to those without LSTV (4% vs 3.6% and 5.8% vs 1.7%, respectively), while no difference was found between the two groups in cases of hip dysplasia of grades B and C.

The HD distribution was analysed in relation to the different types of VTLS. For ease of calculation, the LSTV types from the classification of Flückiger *et al.* of 2006 and Lappalainen *et al.* of 2012 were renamed: independently of the side, the intermediate-lumbar type was called type 1, the intermediate-sacral type 2, the lumbar-sacral type 3, the lumbar-lumbar type 4, the intermediate-intermediate type 5, the sacral-sacral type 6 and the separation of the spinous process of the first sacral vertebra from the median crest was identified as type 7 (Table 4a,b,c,d). The presence of HD resulted homogeneously distributed among the different types of LSTV of the 4 classification systems used.

A total of 15,864 ventrodorsal pelvic radiographs sent to the Fondazione Salute Animale between 2008 and 2017 were analysed, including 117 different dog breeds; LSVT cases were classified based on the 4 classification systems described in the literature.

Table 5 - Distribution of cases with and without LSTV by gender.		
	Males	Females
LSTV	82 (47.2%)	92 (52.8%)
No LSTV	7334 (46.7%)	8448 (53.3%)

Among the subjects with LSTV, 47.2% (82) were male and 52.8% (92) were female. No correlation was therefore found between the sex of the animal and the incidence of LSTV (Table 5).

DISCUSSION

Lumbosacral transitional vertebrae have been classified with four different systems. In 2006, Flückiger *et al.* sub-

The correlation between the presence of LSTV and the grade of hip dysplasia was investigated using the chi-squared test. A p-value <0.05 was considered statistically significant.

divided LSTV into 3 types based on the morphology of the transverse process: a lumbar, an intermediate and a sacral type.[1,2] In the 2009 study by Wigger *et al.*, LSTV was classified into 5 different types: normal vertebra, separation of the spinous process of the first sacral vertebra from the medial crest (L8), malformed but symmetric vertebra, asymmetric transverse processes and a totally asymmetric vertebra.[3] Again in 2009, Flückiger *et al.* divided LSTV into three types: symmetric, asymmetric and separation of the median crest of the sacrum (L8).[4] In 2012, Lappalainen *et al.* classified LSTV into 4 categories based on the morphology of the transverse processes (lumbar, intermediate and sacral) and the presence of L8.[5] The asymmetry of the pelvis caused by lumbosacral transitional vertebrae causes rotation along its longitudinal axis, favouring the development of an asymmetrical HD or of simply arthrosis due to the altered acetabular angle.[16] In the opinion of the authors this is the main consequence of LSTV; a classification that focuses on the symmetry of the vertebre *in toto* rather than one that considers the morphology of the transverse processes may therefore be more functional. In this respect, the classification proposed by Flückiger *et al.* in 2009, in which type 1 has the separation of the median crest (L8), type 2 has abnormal but symmetric transverse processes and type 3 has a totally asymmetric vertebra, appears to be the most suitable.

In this study, the Epagneul Breton and the Hanover Hound are the breeds with the highest prevalence (7.08% and 4.87%, respectively). In the literature, the breed with the highest reported predisposition is the German Shepherd (5.7% to 44%),[2,3,5,7,8,9,10] but in this study the incidence was of only 2.08%, significantly lower compared to what reported in the literature. The reason for such difference may be that in the other studies the German Shepherd was the only breed evaluated.[3,5,7] In the Akita Inu, out of 359 subjects evaluated no cases of LSTV were found; the breed is thus considered not predisposed to LSTV.

In the study no gender predisposition was identified (Table 6), as already reported by N. Damur-Djuric *et al.* and J.P. Morgan;[2,9] however, some authors have identified an increased predisposition in females[9,12] or in males.[13]

The study demonstrates the existence of a correlation between LSTV and HD (Table 3): the incidence of severe grades of dysplasia (D and E) is significantly greater in dogs with LSTV than in those without; the absence of hip dysplasia (grade A) is instead statistically more common (P<0.05) in cases without LSTV (35% vs 49.5%), whereas no difference was found between the two groups in cases of dysplasia of grades B and C. LSTV causes angulation and/or axial rotation on the frontal plane of the pelvis, which causes subluxation and asymmetric joint degeneration due to an altered angle of the dorsal ridge of the acetabulum. The resulting degree of dorsal subluxation of the femoral head and the consequent secondary osteoarthritis (OA) is therefore greater in hips in which the acetabular roof is dorsally rotated, providing reduced dorsal cover.[16] In growing subjects, the abnormal acetabular angle can be corrected by means of DPO (double pelvic osteotomy).[15] While the development of osteoarthritis is certainly a consequence of pelvic asymmetry, in such cases it is unclear whether a predisposition to the development of HD may be a concomitant factor. A normal contralateral hip, favoured by ventral rotation of the acetabular roof, may also mask a predisposition to HD; in such cases, therefore, a VD distraction view may be useful in order to reveal any excessive joint laxity indicative of dysplasia.[14]

A correlation was shown between LSTV and HD (Table 3): the incidence of severe grades of dysplasia (D and E) was significantly higher in dogs with LSTV compared to those without LSTV while the absence of HD (grade A) was statistically more frequent (p<0.05) in cases in which LSTV was not found (35% vs 49.5%).

In addition to being a predisposing factor for the development of OA, LSTV may also predispose the development of the Cauda Equina Syndrome (CES)[1,11] as it reduces the range of motion at the lumbosacral junction, causing increased stress between the last normal lumbar vertebra and the LSTV. Over time, this mechanical stress can be the cause of premature disc degeneration, disc protrusion and facet joint arthritis, with consequent compression of the cauda equina roots, both in the spinal canal and in the vertebral foramina. It should be noted that the clinical signs associated with CES may overlap with

Among the subjects with LSTV, 47.2% (82) were male and 52.8% (92) were female. No correlation was therefore found between the gender of the animal and the incidence of LSTV.

LSTV may predispose the development of the Cauda Equina Syndrome (CES) as it reduces the range of motion at the lumbosacral junction, causing increased stress between the last normal lumbar vertebra and the LSTV. Over time, this mechanical stress can be the cause of premature disc degeneration, disc protrusion and facet joint arthritis, with consequent compression of the cauda equina roots, both in the spinal canal and in the vertebral foramina.

those caused by HD. In patients with both LSTV and HD it is therefore always necessary to perform a complete physical and instrumental evaluation in order to assess both the coxofemoral condition and the possible presence of CES with the associated lumbosacral lesions. Any therapeutic decision, whether orthopaedic or neurosurgical, should never be taken without a prior comprehensive diagnostic evaluation.

A limitation of this study is that only a small percentage of dogs registered with ENCI (Ente Nazionale della Cinofilia Italiana) underwent an official screening assessment for HD at the FSA reading centre. This notwithstanding, the 15,864 dogs examined represent the largest existing population for a study on LSTV.

In conclusion, although no correlation was found between the different types,[3] LSTV is an inherited malformation and therefore the use of affected dogs for breeding is not recommended.[17] In this respect, it is therefore important for the Reading Centre to inform owners of dogs undergoing an official screening examination for HD and with LSTV that the animal is not suitable for breeding and that the condition should be considered in relation to the physical activity of the dog, possibly excluding sporting or working activities.

Classificazione ed incidenza della vertebra di transizione lombosacrale nel cane in Italia

Riassunto

Introduzione: *La vertebra di transizione lombosacrale (VTLS) è una vertebra malformata classificata in base alla morfologia dei processi trasversi ed ai loro rapporti con l'ileo. La prevalenza della VTLS nel cane, riportata in letteratura, varia sia in base alla razza sia in base al Paese dello studio.*

Scopi dello studio: *Descrivere la classificazione della VTLS, individuare una correlazione tra la VTLS, il grado di HD ed il sesso e valutare l'incidenza della VTLS nelle razze sottoposte a diagnosi ufficiale di HD presso la Fondazione Salute Animale (FSA).*

Materiali e metodi: *Sono state analizzate 15864 radiografie ventro-dorsali inviate presso la FSA dal 2008 al 2017. I casi di VTLS sono stati classificati secondo le 4 classificazioni descritte in letteratura. Per ogni razza è stata valutata l'incidenza. Sono stati registrati sesso e grado di HD di ogni caso di VTLS.*

Risultati: *La VTLS è stata trovata in 174 casi appartenenti a 42 razze. Le razze con prevalenza maggiore sono Epagneul Breton (7,08%), Segugio di Hannover (4,87%) e Setter Inglese (4,76%). È stata trovata una differenza statisticamente significativa tra soggetti con VTLS e senza in relazione alla presenza di HD. Non è stata trovata correlazione con il sesso.*

Conclusioni: *Non è stata riscontrata correlazione tra il sesso e l'incidenza di VTLS. La VTLS asimmetrica predispone a HD asimmetrica. La classificazione che ne considera la simmetria in toto può essere la più funzionale.*

KEY POINTS

- LSTV is a vertebral malformation with a significant incidence in many dog breeds; both mild and severe forms have a proven hereditary origin. Affected subjects should therefore not be used for breeding.
- VTLS can be associated with hip dysplasia not so much because of a genetic correlation but because of the resulting pelvic tilt that promotes dorsal subluxation of the hip.
- Dogs with VTLS are at increased risk of developing Cauda Equina Syndrome and should therefore not be engaged in strenuous physical activity.

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