ARTICLE

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THE SPREAD OF GENETICALLY DETERMINED PATHOLOGY OF THE NERVOUS SYSTEM WITH AN AUTOSOMAL RECESSIVE TYPE OF INHERITANCE IN DOGS IN THE VOLGOGRAD REGION

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The article presents data on the prevalence of genetically determined pathology of the nervous system with an autosomal recessive type of inheritance in dogs of various breeds in the Volgograd region. From August 2021 to March 2025, 153 dogs of 22 breeds were tested for 20 nosologies. The results were obtained from 57 males and 96 females used in breeding. The largest number of studies have been performed on the disease degenerative myelopathy (exon 2) – 63 animals with no breed specificity. 14 sick dogs were identified, which amounted to 22.22% and 17 healthy carriers – 26.98%, respectively. A large number of studies, among breed-specific pathologies, were conducted on Charcot-Marie–Tute disease in the Miniature Schnauzer breed – 20 dogs, one sick female and one female carrier of the mutant allele were diagnosed. Healthy carriers of type 4A neuronal ceroid lipofuscinosis were also identified, in the number of five animals out of seventeen. The Russian black Terrier breed has identified a female carrier of juvenile laryngeal paralysis. The study of hereditary encephalitis of pugs reliably revealed one sick male and two healthy female carriers. In the Jack Russell Terrier breed, a female was found to be a sick carrier of spinocerebellar ataxia with myocemia and/or seizures.

Keywords: statistics, prevalence, nervous system, hereditary pathology, dogs

Introduction

Traditionally, selection in breeding was based on the exterior characteristics of the breed, with the preservation or improvement of working qualities for service and hunting dogs. Artificial selection that was carried out at the present stage of the development of biology and medicine does not allow ignoring the possibility of performing a molecular genetic examination of inherited morphological characteristics, color and diseases fixed in the population. Studies based on the detection of relevant mutations make it possible to determine the degree of risk of the occurrence and development of a genetically determined pathology, becoming of paramount importance in breeding work [1,2]. The use of DNA diagnostic methods will eventually reduce the burden of hereditary pathology both in individual dog breeds and among companion animals in general [3].

The aim of the study is to determine the extent of the spread of genetically determined pathology of the nervous system with an autosomal recessive type of inheritance among dogs of different breeds in the Volgograd region.

Materials and methods of research

A retrospective analysis of the results of 153 genetic studies of dogs, in 22 breeds, for 20 hereditary diseases (Table 1), obtained in the laboratory of the Center for Veterinary Genetics "Zoogen" (Russia) and Laboratory for Clinical Diagnostics "LABOKLIN" (Germany), for the period from September 2021 to March 2025. The results were obtained from 57 males and 96 females used in breeding.

Results of the research and discussions

The largest number of studies have been performed on degenerative myelopathy (exon 2), which has no breed specificity. Sixty-three dogs (41.17% n=153), twenty-nine males (46.03% n=63) and thirty-four females (53.96% n=63) were tested, in 18 breeds (Table 2).

Sick animals were identified in the number of fourteen dogs (22.22% n=63), four males (28.57% n=14) and ten females (71.42% n=14). Seventeen healthy carriers (26.98% n=63), nine males (52.95% n=17) and eight females (47.05% n=17) were diagnosed. Healthy animals: thirty-two dogs (50.79% n=63), equally males and females. The results of the study, depending on the breed and gender, are presented in chronological order of the tests, in Table 3.

The data presented in the table convincingly show that the pathology is most common in the breeds Fox Terrier, Welsh Corgi Pembroke, Welsh Corgi Cardigan and German Shepherd. What is sufficiently consistent with the existing global statistics [4-6].

Table 1

Number of tested dogs depending on nosology

№	Nosology	Number of animals
1	Degenerative Myelopathy. Exon 2.	63
2	Charcot-Marie-Tooth disease type 4B2	20
3	Neuronal ceroid lipofuscinosis type 4A	17
4	Juvenile Laryngeal Paralysis (JLPP)	9
5	Pug hereditary encephalitis	8
6	Neuroaxonal degeneration of rottweilers	7
7	Leukoencephalomyelopathy of Great Danes and Rottweilers, LEMP R	4
8	Neuroaxonal dystrophy	4
9	Episodic falling of Cavalier King Charles Spaniels	4
10	Late cerebellar ataxia	3
11	Neuronal ceroid lipofuscinosis type 5	2
12	Early progressive malamute polyneuropathy	2
13	Spinocerebellar Ataxia with Myokymia and/or Seizures	2
14	Sensory Neuropathy Border Collie	2
15	Neuronal ceroid lipofuscinosis type 1	1
16	Neuronal ceroid lipofuscinosis type 2	1
17	Neuronal ceroid lipofuscinosis type 6	1
18	Degenerative Myelopathy. Exon 1.	1
19	Neonatal seizure encephalopathy	1
20	Laryngeal paralysis bull terrier	1

Table 2

Number of studies on degenerative myelopathy (exon 2) depending on the breed of dogs

№	Breed	Number of dogs	% ratio
1	Welsh Corgi Pembroke	19	30,15
2	Welsh Corgi Cardigan	7	11,1
3	East European Shepherd	5	7,93
4	American Staffordshire Terrier	4	6,34
5	German shepherd	4	6,34
6	Fox Terrier	4	6,34
7	Cavalier King Charles Spaniel	3	4,76
8	Siberian Husky	3	4,76
9	American bully	2	3,17
10	Australian Shepherd	2	3,17
11	Rottweiler	2	3,17
12	Miniature schnauzer	2	3,17
13	Bichon frize	1	1,6
14	Bernese Mountain Dog	1	1,6
15	Pug	1	1,6
16	Standard poodle	1	1,6
17	Russian Black Terrier	1	1,6
18	Shih Tzu	1	1,6
	Total animals	63	100

Table 3

The results of a study on degenerative myelopathy (exon 2), depending on the breed and gender of dogs

№	Breed	♂	♀	MM	NM	NN
1	East European Shepherd		+			+
2	Siberian Husky		+			+
3	American Staffordshire Terrier	+			+	
4	Fox Terrier		+	+		
5	Cavalier King Charles Spaniel		+		+	
6	Welsh Corgi Pembroke	+				+
7	Bernese Mountain Dog	+				+
8	Welsh Corgi Pembroke		+			+
9	Pug	+				+
10	Cavalier King Charles Spaniel		+			+
11	German shepherd		+			+
12	Rottweiler	+				+
13	Welsh Corgi Pembroke		+	+		
14	Welsh Corgi Pembroke		+	+		
15	Welsh Corgi Pembroke		+	+		
16	Welsh Corgi Pembroke	+		+		
17	Welsh Corgi Cardigan	+			+	
18	Welsh Corgi Pembroke		+		+	
19	German shepherd		+		+	
20	Cavalier King Charles Spaniel	+				+
21	Welsh Corgi Pembroke		+			+
22	Welsh Corgi Cardigan		+		+	
23	Welsh Corgi Cardigan	+				+
24	Welsh Corgi Cardigan		+			+
25	Welsh Corgi Cardigan		+	+		
26	Welsh Corgi Pembroke	+			+	
27	Welsh Corgi Pembroke	+		+		
28	Standard poodle		+			+
29	Welsh Corgi Pembroke		+	+		
30	Russian Black Terrier		+			+
31	East European Shepherd	+				+
32	German shepherd		+		+	
33	Bichon frize	+				+
34	East European Shepherd	+				+
35	Welsh Corgi Pembroke	+			+	
36	Shih Tzu		+			+
37	East European Shepherd	+			+	
38	Welsh Corgi Pembroke		+	+		
39	German shepherd	+			+	
40	Fox Terrier		+	+		
41	East European Shepherd	+				+
42	Australian Shepherd		+			+
43	Siberian Husky		+			+

End of table 1

№	Breed	♂	♀	MM	NM	NN
44	Welsh Corgi Pembroke		+		+	
45	Welsh Corgi Pembroke	+			+	
46	American bully	+				+
47	American Staffordshire Terrier	+				+
48	American Staffordshire Terrier	+				+
49	Welsh Corgi Cardigan		+		+	
50	Fox Terrier	+		+		
51	American bully	+				+
52	Australian Shepherd		+			+
53	Rottweiler	+				+
54	American Staffordshire Terrier		+			+
55	Welsh Corgi Pembroke		+	+		
56	Welsh Corgi Pembroke	+		+		
57	Siberian Husky		+			+
58	Welsh Corgi Pembroke	+			+	
59	Welsh Corgi Cardigan		+		+	
60	Miniature schnauzer		+			+
61	Miniature schnauzer	+				+
62	Welsh Corgi Pembroke	+			+	
63	Fox Terrier		+	+		

♂ – male; ♀ – female; MM – sick; NM – healthy, carrier; NN – is healthy.

A large number of studies, among breed-specific nosologies, have been conducted in the Miniature Schnauzer breed for Charcot-Marie-Tooth disease, which is one of the most common demyelinating peripheral neuropathies among both humans and dogs of this breed [7-9]. Twenty dogs (13.07% n=153), six males (30% n=20) and fourteen females (70% n=20) were tested. Of all the animals, one sick female (5%) and one female carrier of the mutant allele (5%) were identified, eighteen healthy non-carriers (90%). Neuronal ceroid lipofuscinosis type 4A was studied in seventeen animals (11.11% n=153), in three breeds: American Staffordshire Terrier – 13 (76.47% n=17), American bully – 3 (17.64% n=17) and American Pit Bull Terrier – 1 (5.88% n=17). There were eight males (47.05% n=17) and nine females (52.95% n=17). Healthy carriers were identified in the number of five dogs (29.41% n=17). Nine animals (5.88% n=153) were tested for juvenile laryngeal paralysis / polyneuropathy, in two breeds: Rottweiler – 7 (77.77% n=9) and Russian Black Terrier – 2 (22.22% n=9). There were three males (33.33% n=9) and six females (66.66% n=9). One female carrier (11.11% n=9) of the Russian Black Terrier breed was identified. Diagnosed nosologies are quite widespread in "their" breeds, with a progressive course and an unfavorable prognosis [10-13]. Hereditary encephalitis of pugs – eight representatives of the breed (5.22% n=153), three males (37.5% n=8) and five females (62.5% n=8) were diagnosed. One sick male (12.5% n=8) and two healthy female carriers (25% n=8) were identified. The results obtained correlate with the data in the European pug population [14]. In the Jack Russell Terrier breed, out of two dogs (1.3% n=153), spinocerebellar ataxia with myocemia and/or seizures was detected in a female (50%), the second animal is a healthy male who does not carry the disease. In the available literature, this nosology is presented as a progressive neurodegenerative disease of young terriers. To objectively assess the extent of the pathology in the region, the number of tests performed is insufficient. The animal was admitted with clinical signs of ataxia and seizures at the age of one year, which generally corresponds to the existing concepts of the disease [15]. Among the dogs tested for diseases: papillon neuroaxonal dystrophy (n=4), episodic fall syndrome (n=4), late cerebellar ataxia

(n=3), Great Dane and Rottweiler leukoencephalomyelopathy (n=4), Rottweiler neuroaxonal dystrophy (n=7), bull terrier laryngeal paralysis (n=1), neuronal ceroid lipofuscinosis type 5 (n=2), neuronal ceroid lipofuscinosis type 6 of Australian Shepherds (n=1), Border Collie sensory neuropathy (n=2), early progressive polyneuropathy of malamutes (n=2), neuronal ceroid lipofuscinosis type 1, dachshunds (n=1), neuronal ceroid lipofuscinosis type 2 (n=1), degenerative myelopathy (exon 1) (n=1), and neonatal encephalopathy with seizures (n=1) were not detected in sick animals or carriers.

Conclusions

In the Volgograd region, genetic research on hereditary diseases is quite widespread. Nosologies associated with individual breeds are mainly diagnosed. Among the diseases of the nervous system with an autosomal recessive type of inheritance, the most common is degenerative myelopathy (exon 2), common to all breeds. In half of the cases, sick and healthy carriers of the mutant allele were identified. A large number of studies, among breed-specific pathologies, were conducted on Charcot-Marie-Tooth disease in the Miniature Schnauzer breed, one sick female and one carrier female were diagnosed. Sick dogs were identified with the diseases hereditary encephalitis of pugs and spinocerebellar ataxia with myokymia. Further, healthy carriers of neuronal ceroid lipofuscinosis type 4A, hereditary pug encephalitis and juvenile laryngeal paralysis were identified in descending order.

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