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Hereditary spino-cerebellar ataxia in a large Brazilian Kindred

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Friedreich, in 1863, was the first to describe a hereditary ataxia due to a degeneration of certain medullary regions. Marie (1893), having found cases involving primary affections of the cerebellum, classified them as a distinct entity. Several authors, however, came across intermediate forms of these two diseases. This led different investigators (for instance, Bell and Carmichael, 1939), to consider them as clinical variations of the same morbid condition. This opinion was confirmed by genetic data. Thus, Schut (1951) encountered, in a large family, one case of Friedreich disease, 19 cases of hereditary cerebellar ataxia, and 2 cases of hereditary spastic paraplegia.

The present paper deals with data obtained in a large Brazilian family, of white ancestry, in which several members presented signs of a spino-cerebellar degeneration. This family was studied with two objectives in mind: a) the analysis of the main clinical signs of the disease. Here it was found an unexpected alteration in the heat sensibility of the affected individuals; b) linkage studies with the blood group genes.

The more important neurological findings, as well as data concerning the inheril tance of the disease in this family, will be described here. The linkage studies are stil- in progress and will be presented in another communication.

Material and methods

The family was ascertained through informations given by one of their affected members (III – 51, Fig. 1). This person, who complained of a sciatic syndrome, was a patient of the 15th Infirmary of the Santa Casa de Misericordia de Pôrto Alegre. This is a hospital for indigent people, serving simultaneously as a field of observation for the staff of the School of Medicine.

All the available members of the kindred were examined at their homes, by the author. The individuals were considered as not affected when the reflexes, the deep sensibility, and the coordination were normal. The affected members still living at the

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time of the research gave informations concerning the date and mode of onset of the disease, as well as about the evolution of the symptoms. Data were collected also regarding personal antecedents, venereal diseases, and drinking and smoking habits. Afterwards, a neurological examination was performed, as complete as the conditions permitted. It consisted of the following items: 1) Psyche (considered lucid when the understanding and memory seemed satisfactory, and the informations given were in accordance with reality, always considering the intelectual level of the patient); 2) Visual inspection (looking, especially, for deformities as pes cavus and kypho-scoliosis); 3) Equilibrium (tested by the Romberg signal); 4) Gait; 5) Voluntary motility; 6) Involuntary motility; 7) Coordination (by the tests finger-to-nose, finger-to-finger and ankle-to-knee; at this point the presence of intentional trembling was verified. The diadochocinesia was tested by the marionette proof; 8) Nystagmus; 9) Pupillary reflexes (of accommodation, photo-motor, consensual); 10) Deep reflexes (in the upper limbs, tricipital, bicipital and stylo-radial; in the lower limbs, patellar and Achilles tendon reflex); 11) Superficial reflex (only the plantar); 12) Muscular tonus (by palpation and test of the amplitude of passive movements); 13) Stereognosis; 14) Superficial sensibility (touch, temperature and pain) and deep (vibratory, positional) determined by the usual methods. However, the tests were restricted to the face and members, by the resistance which some patients presented to a more complete examination; 15) Language (when there was no expontaneous dysarthria, this condition was looked for by sentences of difficult articulation).

Blood samples were also collected in the affected persons and their parents and sibs. The blood tests performed were: 1) Determination of the blood groups (to detect possible linkage between genes determining the two characteristics); 2) Electrophoresis of the serum proteins; 3) Lues reactions (Wassermann, Kahn), in the suspected cases. The electrophoresis and blood group data will be the subject of a separate publication.

As to the dead patients, informations about them were collected by interrogation of their nearest relatives. However, because these informations did not appear totally reliable, the discussion of the clinical data will be restricted to the ataxic living patients, all examined.

Description of the family

Informations were obtained involving six generations, in a total of 337 related individuals (Fig. 1). 116 of these were examined by the author. As it can be seen in Fig. 1, 18 of them presented the disease, and of these, 10 were still alive at the time the research was done. It was possible, also, to determine a carrier of the gene conditioning the affection, deceased in a preataxic age.

A summary will be given, now, of the anamnesis and neurological examination of the affected persons. In what follows, the Roman numerals refer to the generation, and the arabic to the situation of the individual in this generation.

I-1 – M.M.C., male, white, married, deceased with approximately 65 years. His disease started with walking disturbances, which was like one of a drunk person. The disease became progressively worse, and some time before his death he could not walk any more.

II-1 – M.L.C., female, white, married, deceased due to a cardiopathy when she was 64 years old. The onset of the disease became apparent with walking disturbances; after that she started to feel vertigoes and became progressively paralytic.

II-5 – I.C.C., male, white, married, deceased with 66 years. The only information which could be obtained about him was that the patient presented the same disease of his sick descendents.

II-6 – H.C.C., female, white, single, deceased with 30 years, of typhoid fever. She presented great walking incoordination, suggestive of the disease.

II-9 – J.C.C., male, white, married, deceased with 48 years. At the age of 30 his walking became characteristic of an ataxic person, and the affection progressed slowly until his death.

II-10 – A.C.C., male, white, single, deceased with 26 years, presenting walking disturbances.

II-12 – M.C.R., female, white, married, deceased with 24 years, of typhoid fever, without showing any sympton characteristic of the disease.

II-13 – E.C.C., male, white, married. The disease started when he was approximately 30 years old, with pain in the articulations of the lower limbs, walking and equilibrium disturbances. These symptoms became progressively worse, dysarthria appeared, and at the age of 49 he died of liver disease.

III-6 – A.C.S., female, white, widow, 56 years-old. Does not drink, does not smoke, and denies any past venereal disease. Her sickness started at the age of 38, with walking disturbances. Some two years latter she started to feel vertigoes. Both symptoms became progressively worse, and she had to retire from her work at the age of 50. Presently, the feeling of dizziness is permanent and she walks only when helped by another person, and even so with great difficulty. She refers dysphagia to solid and liquid foods.

Objective examination:

Psyche lucid. Dysstasia. Ataxic gait. Slight involuntary trembling, in the distal extremity of the superior and inferior limbs. Dysmetria with intentional trembling in the upper limbs. Coordination proofs of the lower limbs were not made due to the lack of cooperation of the patient, who complained of arthralgia. Adiadochocinesia. Nystagmus not present. Pupillary reflexes normal. Deep reflexes diminished in the upper limbs and absent in the lower ones. Absence of plantar reflex. Muscular hypotony. Normal stereognosis. Sense of touch, normal. Sense of pain, diminished in the four limbs, disturbances in the temperature sense in the four limbs and face. Deep sensibility abolished in the lower limbs, vibratory sense diminished in the upper limbs. Slight dysarthria. Blood test for lues negative.

III-7 – I.C.C., female, white, married, deceased with 51 years, due to a cardiopathy. The walking difficulties started around 41 years of age, becoming progressively worse, also appearing vertigoes and dysphagia.

III-17 – I.J.C., male, white, married, 51 years old. He smokes and drinks moderately, and has had blenorrhagia when 21 years old. His sickness started at 48, with a subjective difficulty in walking; the disease has not progressed sensibly, but, some months ago, he started to feel vertigoes and pain in the knee joint.

Objective examination:

Psiche lucid. The right leg is 1,5 cm shorter than the left one. Romberg sign present. Walking is made with the legs in a rigid position; the patient attributes it to pain in the knee

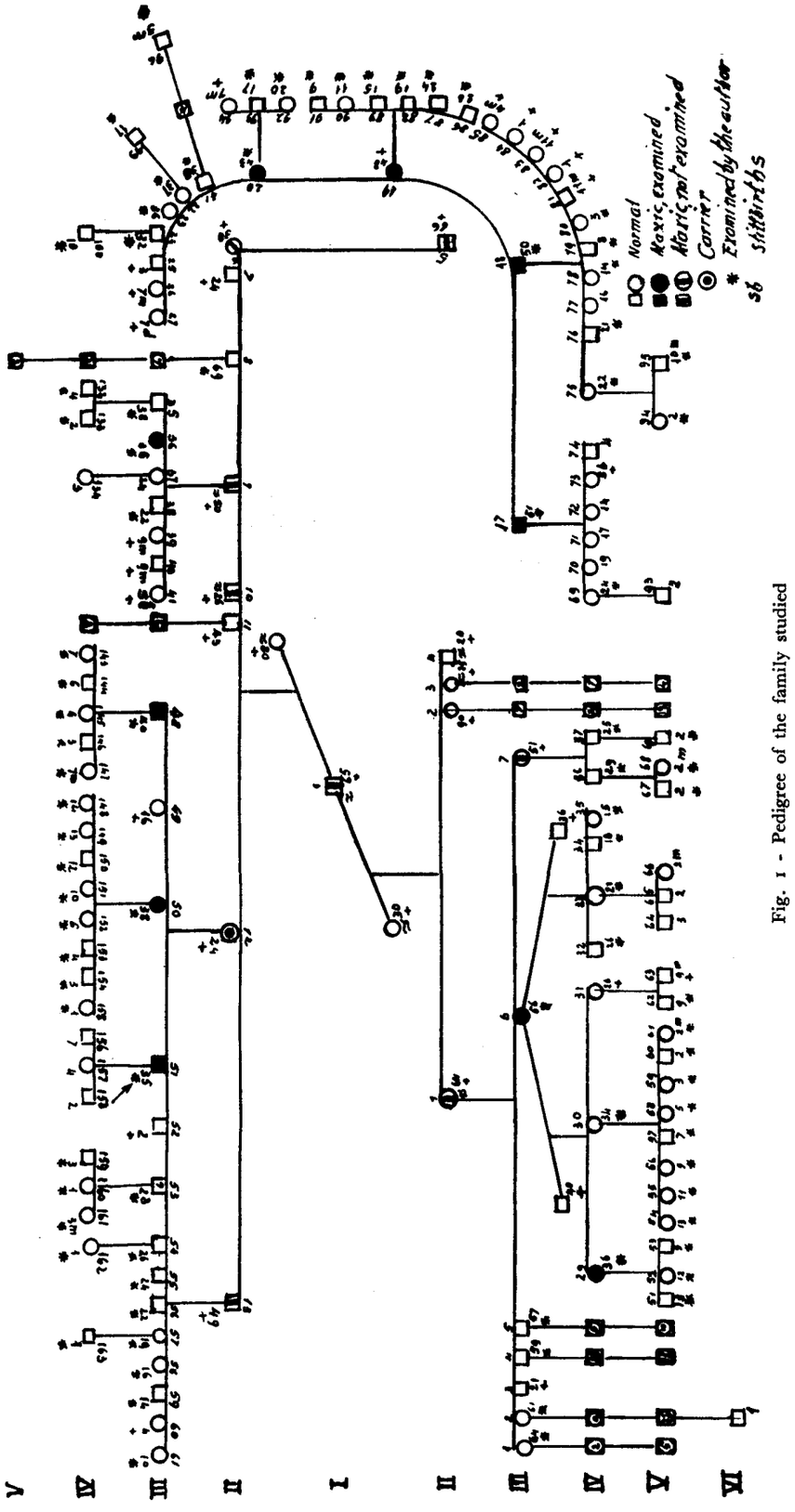

Fig. 1 - Pedigree of the family studied

Table - 1 Summary of the main data of anamnesis and inspection

Reference	Name	Sex	Age	Age of onset	Vertigo	Psyche	Pes cavus	Kypho-scoliosis	Observations
III-6	A.C.S.	♀	56	38	Yes	Lucid	No	No	—
III-17	I.J.C.	♀	51	48	Yes	Lucid	No	No	—
III-18	J.J.C.	♀	50	45	Yes	Lucid	No	No	—
III-19	V.C.M.	♀	48	40	Yes	Lucid	No	No	—
III-20	M.I.M.	♀	43	40	Yes	Lucid	No	No	—
III-36	E.R.C.	♀	35	15	Yes	Lucid	Yes	Yes	Two times operated from a cyst of arachnoid
III-48	O.C.R.	♂	40	35	Yes	Lucid	Yes	No	—
III-50	O.R.R.	♂	38	32	Yes	Lucid	Yes	No	—
III-51	A.C.R.	♂	35	32	Yes	Lucid	Yes	No	—
III-29	E.S.E.	♀	36	35	No	Lucid	No	No	—

Table 2 - Some of the main neurological findings, especially those suggesting cerebellar alterations

Reference	Ataxic gait	Dysmetria, upper limbs	Intentional trembling, upper limbs	Dysmetria, lower limbs	Intentional trembling, lower limbs	Adiado-chocinesia	Nystagmus	Muscular tonus	Dysarthria
III-6	+	+	+	=	=	+	O	<	+
III-17	O	+	O	+	+	O	+	<	O
III-18	O	+	+	+	+	O	O	n	O
III-19	+	+	+	+	+	+	+	<	+
III-20	+	+	O	+	O	+	+	n	+
III-36	=	+	+	=	=	+	+	<	+
III-48	+	+	+	+	+	+	+	<	+
III-50	+	+	+	+	O	+	+	<	O
III-51	+	O	O	+	O	O	+	<	O
IV-29	+	+	+	+	+	O	O	n	O

= not studied; n = normal; + = present, positive; O = absent, negative, abolished; > augmented; < diminished

Table 3 - Some of the main neurological findings, especially those suggesting posterior chord and pyramidal lesions and those concerned with the temperature sense

Reference	Romberg sign	Vibratory sense, upper limbs	Positional sense, upper limbs	Vibratory sense, lower limbs	Positional sense, lower limbs	Deep reflexes, upper limbs	Patellar reflex	Achilles tendon reflex	Babinski	Thermic sensibility, upper limbs	Thermic sensibility, lower limbs
III-6	=	<	n	O	O	<	O	O	O	O	O
III-17	+	O	n	O	n	n	n	O	O	n	n
III-18	O	n	n	O	n	n	O	O	O	n	O
III-19	O	n	O	n	O	>	>	>	O	n	O
III-20	+	n	n	n	n	n	>	n	O	n	O
III-36	=	n	n	O	n	>	>	n	+	O	O
III-48	+	n	O	O	O	n	>	n	O	O	O
III-50	+	n	n	n	n	n	>	n	O	n	O
III-51	+	n	n	O	n	n	n	n	O	n	O
IV-29	O	n	n	O	n	n	>	n	O	n	n

n = normal; = not studied; + = present, positive; O = absent, negative, abolished; > augmented; < diminished.

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joints. Dysmetria in the upper limbs, dysmetria with intentional trembling in the inferior ones. Horizontal nystagmus when looking to the sides. Pupillary reflexes without particularities. Deep reflexes of the upper limbs, normal; patellar, normal; Achilles tendon reflex abolished. Plantar reflex normal; muscular hypotonia. Normal stereognosis. Superficial and positional sensibility normal. Vibratory sense abolished in the four limbs. Speech normal. Blood test for lues negative.

III-18 – J.J.C., male, white, married, 50 years old. He smokes and drinks moderately and denies venereal diseases. Walking disturbances started when he was 45 years old. Since then he started to feel vertigoes, which still persist.

Objective examination:

Psyche lucid. Romberg sign absent. Walking, voluntary and involuntary motility normal. Dysmetria with intentional trembling in the upper and lower limbs. No nystagmus. Pupillary reflexes, normal. Deep reflexes, normal in the upper limbs and abolished in the inferior ones. Plantar reflex normal. Normal stereognosis. Disturbances in the temperature sense and abolishment of the vibratory sense in the legs. Speech, normal. Blood test for lues negative.

III-19 – V.C.M., female, white, married, 48 years old. Does not drink, does not smoke, and denies venereal diseases. At the age of 40 she started to feel pain in the lower limbs, mainly on the knee joint. At the same time, she noticed walking disturbances, which became progressively worse. Some years afterwards, she started to feel vertigoes.

Objective examination:

Psyche lucid. Romberg sign absent. Ataxic gait. Slight static trembling in the distal part of the upper and lower limbs. Dysmetria with intentional trembling in the four limbs. Adiadochocinesia. Horizontal nystagmus when looking to the sides. Pupillary reflexes normal; plantar reflex normal; deep reflexes increased. Muscular hypotonia. Stereognosis, tactile and pain sensibility normal. Disturbance of the temperature sense in the lower limbs. Positional sense abolished in the four limbs. Vibratory sense normal. Dysarthria.

III-20 – M.I.M., female, white, married, 43 years old. She drinks and smokes moderately, and denies venereal diseases. Her sickness started three years ago, with walking disturbances. Some time afterwards she started to feel vertigoes, which became permanent.

Objective examination:

Psyche lucid, Romberg sign present. Ataxic gait. Dysmethria in the four limbs. Adiadochocinesia. Horizontal nystagmus when looking to the sides. Patellar reflexes increased, all others normal. Normal muscular tonus. Stereognosis, tactile, pain, vibratory and positional sensibilities normal. Temperature sense disturbed in the lower limbs. Dysarthria.

III-36 – E.R.C., female, white, single, 35 years old. Does not drink or smoke and denies venereal diseases. At the age of 15 she started to feel weakness in the lower limbs, with equilibrium disturbances. At age 28 the walking disturbances had progressed to a point to be noted by her relatives. The weakness of the lower limbs increased and she could not walk any more. At the age of 30, she went to the Institute of Neurosurgery of the Santa Casa de Misericordia de Pôrto Alegre. The neurological examination performed then revealed a syndrome of medullary compression, and the myelography showed a partial stop in the region corresponding to D-10 and D-11. She was operated, and the presence of an arachnoid, delimitated cyst, was observed. It included the posterior and lateral portion of the medulla. The cyst was opened and almost all the capsule removed. The patient left the hospital in

good conditions, sensibly better, walking on her own feet. She returned one year latter, with the same complaints, and was reoperated of a new arachnoid cyst with a diameter of 3 cm. She left the hospital again in good conditions, not returning again to the Institute. These are the data obtained from the Institute's files. The patient, however, says that her condition became worse with the two operations, and atributes to them her incapacity to walk. She reffers the appearance of vertigoes, without specifying the exact date.

Objective examination:

Psyche lucid. Pes cavus. Kypho-scoliosis. Abasia and astasia. Dysmetria with intentional trembling in the arms; coordination tests could not be performed in the legs, due to non-cooperation. Adiadochocinesia. Horizontal nystagmus when looking to the sides. Pupillary reflexes normal; deep reflexes increased in the upper limbs; patellar increased and oscillatory; Achilles tendon reflex, normal, bilateral Babinski reflex. Upper limbs with great muscular hypotonia, spastic lower limbs. Normal stereognosis, tactile and pain sensibility normal, temperature sensibility disturbed in the four limbs. Positional sense normal, vibratory sense disturbed in the lower limbs. Dysarthria. Blood test for lues negative.

III-48 – O.C.R., male, white, married, 40 years old. Smokes but does not drink, blenorrhagia at age 22. His symptoms started at 35, with intermitent trembling in the arms. One year latter he noticed equilibrium and walking disturbances, with weakness in the lower limbs. Vertigoes started with the progress of the symptoms.

Objective examination:

Psyche lucid. Pes cavus. Romberg sign present. Ataxic gait. Dysmethria with intentional trembling in the four limbs. Adiadochocinesia. Horizontal nystagmus when looking to the sides. Deep reflexes normal in the arms, patellar increased, Achilles tendon reflex normal. Plantar reflex normal. Muscular hypotonia. Normal stereognosis. Tactile and pain sensibility normal. Temperature sense disturbed in the four limbs and face. Positional sense abolished in the four limbs, vibratory sense abolished in the lower ones. Dysarthria.

III-50 – O.R.R., female, white, married, 38 years old. Does not drink or smoke and denies venereal diseases. At the time she married, when she was 23 years old, she started to feel weakness in the lower limbs. At 32, the walking disturbances started and became progressively worse. Vertigoes appeared some time afterwards.

Objective examination:

Psyche lucid. Pes cavus. Romberg sign present. Ataxic gait. Dysmethria in the four limbs, with intentional trembling in the upper ones. Adiadochocinesia. Horizontal nystagmus when looking to the sides. Pupillary reflexes normal. Deep reflexes of the upper limbs, normal; patellar increased. Achilles tendon reflex normal; plantar normal; muscular tonus diminished. Normal stereognosis. Tactile and pain sensibility normal; temperature sense disturbed in the legs. Deep sensibility normal. Speech normal.

III-51 – A.C.R., the propositus, male, white, married, 35 years old. He smokes and drinks occasionaly; denies venereal diseases. He entered the 15 th Infirmary of the Santa Casa de Misericórdia de Pôrto Alegre on April 8, 1959, complaining of a sciatic syndrome. It started when he tried to lift a weight, by an acute pain in the lumbar sacral region and right gluteus, irradiating along the posterior face of the right lower limb. The pain was discontinuous, but

appeared at the slightest movements, and forced the patient to seek the hospital. Three years ago he had a similar crisis, which disappeared spontaneously. At the same time, he started to feel equilibrium disturbances in walking, which appeared intermitently. Later, this walking disturbance became permanent, and vertigoes appeared.

Objective examination:

Psyche lucid. Pes cavus. Romberg sign present. Ataxic gait. Dysmethria in the legs. Horizontal nystagmus when looking to the sides. Pupillary reflexes normal. Deep and superficial reflexes normal. Muscular hypotonia. Normal stereognosis. Tactile and pain sensibility normal. Positional sense normal. Temperature sense disturbed and vibratory sense abolished in the lower limbs. Speech normal.

III-53 – A.C.S., female, white, married, 28 years old. Does not smoke or drink and denies venereal diseases. Does not present any of the symptoms characteristic of the disease, but shows a very discrete dysmethria in the ankle-to-knee test and disturbance of the temperature sense in the legs. It is possible that she is a carrier of the gene, not manifesting, yet, the disease.

IV-29 – E.S.E., female, white, married, 36 years old. She drinks occasionally, but does not smoke and denies venereal diseases. She started to notice walking disturbances one year ago. Does not feel vertigoes.

Objective examination:

Psyche lucid. Romberg sign absent. Ataxic gait. Dysmethria with intentional trembling in the four limbs. Deep reflexes of the upper limbs normal. Patellar augmented, Achilles tendon reflex normal. Plantar abolished. Muscular tonus normal. Normal stereognosis. Superficial sensibility normal. Positional sense normal. Vibratory sense abolished in the lower limbs. Speech normal.

Analysis of the data of anamnesis and inspection

A summary of the data referring to these characteristics can be seen in table 1.

In regard to the *age of onset* of the first symptoms, it should be pointed out first that this is a difficult figure to be determined, since they appear in an intermitent and insidious manner. With this reservation in mind, we verify that it varied from 32 to 48 years, with a mean of 38.33 ± 1.74. The case of patient III-36, who referred the initial symptoms at age 15, was not considered. She carried a cyst of arachnoid, also, and this fact could explain this early onset.

The *incidence in the two sexes* was practically the same. Including persons living, dead, and XI-12, carrier of the gene, the condition was present in 9 men and 10 women.

All the affected persons presented a *lucid psiche*. They always referred to *vertigoes*, with the exception of IV-29, in which the disease was present in a very early stage.

In relation to *deformities*, four patients were found with pes cavus and one of them with kypho-scoliosis.

Neurological disturbances

Tables 2 and 3 summarize the main neurologic findings.

As it can be seen there, a cerebellar syndrome was observed in all the cases. It was characterized by dysmethria (10 cases); intentional trembling (8); ataxic gait (7); nystagmus (7); muscular hypotonia (7); adiadochocinesia (6); dysarthria (5).

All the patients presented also a *posterior medullary syndrome* characterized by: vibratory sense disturbances (7); positive Romberg sign (5); altered positional sense (3); abolishment of the deep reflexes of the lower limbs (2).

In six of the patients *pyramidal alterations* were found, characterized by hyperreflexia mainly of the patellar reflexes. The Babinski sign was found in patient III-36, but she had also a cyst of arachnoid.

The *thermic sensibility* was altered in eight of the ten cases studied.

Genetic analysis

The disease is inherited as if due to a dominant autosomal gene (Fig. 1). All the individuals who presented signs of it had at least one of the parents affected also, with the exception of the offspring of XI-12, who died in a preataxic age. The expected proportion of affected: non affected individuals is 1:1 in the sibships with sick persons. The criteria used for the classification of a patient in the normal category was the absence of neurologic alterations at age 35 (corresponding to the mean age of onset of the first symptoms in our material, minus two times the standard error of the mean). With this criteria, not including, of course, the propositus, a proportion of 17:11 was found. These numbers are not significantly different from the expected values. In regard to the birth order, no correlation was found between this variable and the disease. As it can be seen in Fig. 1, the siblings born earlier (for example, III-17 to III-20) as well as those late-born (III-6 and III-7) can be affected.

The viability of the abnormal persons does not seem to be lower than those of their relatives. For instance, III-6 has 56 years, and her mother and grandfather, also affected, reached the approximate age of 64 and 65 years, respectively, according to informations given by members of the family (Fig. 1).

No statistically significant fertility differences were found between ataxic and non-ataxic people, in the family studied. The ataxic women had a mean number of children of 4.50 ± 0.95, while their normal women relatives had 4.33 ± 0.89. The number for the general white population, according to the 1950 census, is 5.58 (Mortara, 1957). The ataxic men had a mean number of $8.12 \pm 1,14$, against 4.33 ± 0.89 of their relatives from the same sex. There is an apparent (not significant) increase in the number of children born from ataxic fathers. This probably is due to chance. In order to make the two groups comparable, the mean number of children born from healthy people was calculated only from persons older than 35, the age limit for the onset of the first symptoms. No increase in the frequency of unmarried persons was found among the affected, either.

It is interesting to note that, of the four cases in which pes cavus were found, three occurred among brothers (III-48, III-50, and III-51). The remaining patient is III-36, who, as was mentioned several times before, constitutes a very special case. The presence of the deformity in three brothers suggest the influence of genetic modifiers in the appearance of this condition.

Discussion

The different clinical symptoms of this disease depend on the localization and extension of the lesions in the nervous system, of the time of onset, as well as on other factors. Therefore, a satisfactory classification is difficult to be made. The cases studied here can be placed among those classified by Bell and Charmichael (1939) as group B (spastic ataxia with presence or exageration of the deep reflexes). As a matter of fact, in only two of the present cases were the patellar and Achilles tendon reflexes abolished. In Sjögren's nomenclature (Sjögren, 1943), our cases would be included in group III (Pierre Marie's cerebellar ataxia).

While these authors mentioned alterations in the deep sensibility, mainly on the distal extremity of the lower limbs, and Sjögren had found in 31% of the cases disturbances in the superficial sensibility, they did not mention characteristic disturbances in the temperature sense. In the material here studied, however, this sense was abolished in the lower, or lower and upper limbs, in eight of the ten cases (Table 3). The two only exceptions, IV-29 e III-17, presented the onset of the disease at just 1 and 3 years ago, respectively. The touch and pain sensibility were practically not affected.

The question of vertigo in association with hereditary ataxia, because it involves a vague subjective state, has not received more attention from other authors. In the material presented in this paper, however, all the patients complained of it.

The several types of spino-cerebellar ataxias can be inherited through dominant, recessive or, more rarely, sex-linked genes (Bell and Carmichael, 1939, Sjögren, 1943). In the types inherited through a dominant gene, the age of anset of the disease generally occurs at a relatively late period. This is to be expected, since an early onset would prevent the affected individual from transmitting the gene to its offspring. In the family under study, the inheritance is of the dominant, autosomal type, and the age of on set relatively late (38.33 ± 1.74). This result is not statistically different from that obtained by Bell and Carmichael (1939) and Sjögren (1943) in the groups correspondent to the one here described.

No predominance of affected individuals in one of the sexes was found in the family studied; this agrees also with results obtained by other authors. No alterations in the viability and fertility of the sick persons were found, either. Therefore, as all hereditary diseases of late onset, this type of spino-cerebellar ataxia does not seem to be under the influence of natural selection.

Summary

A large Brazilian family, of white ancestry, in which several members presented a spino-cerebellar ataxia, was studied. Informations were obtained covering six generations, in a total of 337 related individuals. 116 of them were examined by the author. 18 presented the disease, and of these 10 were alive at the time of the study. Besides them, by her descendents, it was possible to find a carrier of the gene, who died in a preataxic age.

The disease is transmitted by an autosomal dominant gene, and appears at the age of 38.33 ± 1.74 years. Cerebellar, posterior chord and pyramidal alterations were present in the sick persons. Almost all the patients presented disturbances of the temperature sense. The disease had not lowered the viability and fertility of the affected persons.

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RIASSUNTO

Il presente lavoro riferisce studi fatti su una numerosa famiglia brasiliana, di color bianco, in cui diversi membri presentavano un'atassia spino-cerebellare. Le informazioni ottenute si estendono a sei generazioni, in un totale di 337 individui apparentati; 116 di questi sono stati esaminati dall'autore, 18 presentavano la malattia e 10 erano vivi al momento in cui fu fatto lo studio. Oltre a questi, attraverso i suoi discendenti, è stato possibile identificare una portatrice del gene, morta in età preatassica.

Il male trasmesso da un gene autosomale dominante, appare all'età di 38, 33 × 1,74 anni. Alterazioni cerebellari, midollari posteriori e piramidali sono state osservate in persone colpite dal male. Quasi tutti i pazienti presentavano dei disturbi della sensibilità termica. Il male non ha diminuito la viabilità e la fertilità delle persone colpite.

RÉSUMÉ

Ce travail nous présente des études faites dans une nombreuse famille brésilienne, de couleur blanche, dans laquelle plusieurs membres présentaient une ataxie spino-cerebelleuse héréditaire. Les informations obtenues couvraient six générations, pour un total de 337 individus enregistrés; 116 d'entre eux ont été examinés par l'auteur. 18 présentaient la maladie et, parmi ceux-ci, 10 étaient vivants à l'époque de l'étude. A part ceux-là, il a été possible par ses descendents, d'identifier une conductrice du gène, morte à l'âge pré-ataxique.

La maladie est transmise par un gène autosomique dominant, et apparaît à l'âge de 38,33 × 1,74 ans. Des altérations cérébelleuses, cordonales postérieures et pyramidales ont été observées chez les malades. Presque tous les patients présentaient des troubles de la sensibilité de la température. La maladie n'a diminué ni la viabilité ni la fertilité des personnes affectées.

ZUSAMMENFASSUNG

Die vorliegende Arbeit enthält Mitteilungen über die Krankheit Heredotaxie, welche bei einer mehrköpfigen, weissfarbigen, brasilianischen Familie nachzuweisen war. Die Angaben beziehen sich auf 6 Generationen mit einer Gesamtzahl von 337 Individuen. 116 davon wurden vom Verfasser untersucht. Bei 18 wurde die Krankheit festgestellt; davon lebten 10 während dieser Untersuchungen. Ausser diesen Fällen wurde unter ihren Nachkommen eine Uebertragerin des Gens festgestellt, welche jedoch vor dem Alter, in dem die Ataxie auftreten dürfte, starb.

Diese Krankheit vererb tsich durch ein autosomes dominantes Gen und tritt im Alter von 38,33×1,74 Jahren auf. Fast alle Patienten zeigten Störungen des Temperatursinnes. Die Krankheit verursachte keine Minderung der Viabilität und Fertilität der behafteten Personen.

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