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An extended Family with a Dominantly Inherited Speech Disorder

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Few speech disorders are inherited in a simple Mendelian way, and when familial clustering does occur, both genetic and environmental factors are involved. The genetic contribution in most cases involves more than one gene (polygenic inheritance), although a dominant gene with reduced penetrance is possible. In practice, it is unusual to find full penetrance of a speech disorder occurring in a regular manner over generations.

The family reported here was referred to the genetics clinic from a speech and language unit, where seven affected members were pupils and other children in the same family had previously been pupils. The children had serious communication difficulties and their speech disorder was classified as a severe form of developmental verbal apraxia, since both speech and expressive language were involved. The unaffected members of the family attended normal schools and had normal speech and language development. The unusual regular transmission of the speech disorder prompts us to report this family, since it suggests that at least one type of dyspraxia is simply inherted.

Representative case histories

CASE 1

R.N. (d.o.b. 27.2.72) is patient III_1 on the pedigree shown in Figure 1. This boy is the oldest of nine children born to unrelated parents. The pregnancy was normal and there were no neonatal problems. He spoke no words at 18 months, and by 2 years 5 months his mother was concerned about his speech delay. Other aspects of his development were normal. From the age of six years he attended a school for children with speech and language difficulties. A report by an educational psychologist at the age of 12 years 9 months concluded that he functioned over a wide range of levels, but most were clustered around his chronological age or slightly higher.

At 16 years his height was on the 75th percentile, weight was just under the 50th percentile and occipitofrontal circumference (OFC) was 56cm (50th percentile). On examination, there was no facial weakness and there were full movements of the tongue and palate. He had no abnormal neurological signs. His speech was understandable, but not fluent because of searching for words. He used short, simple sentences, which were often telegrammatic. His comprehension of speech and his reading, spelling and mathematical abilities were adequate for most social occasions, but below those expected for his chronological age. Hearing and vision were normal.

CASE 2

D.N. (d.o.b. 14.7.83) is patient III_9 on the pedigree (Fig. 1). She is the youngest of nine children and was the second of dizygotic twins, with a birthweight of 3630g. Apart from mild jaundice, there were no neonatal problems. She sucked and fed well. Left-sided plagiocephaly was noted and kyphoscoliosis developed. X-rays of the spine showed fusion of the 5th to 10th thoracic vertebrae. Early development

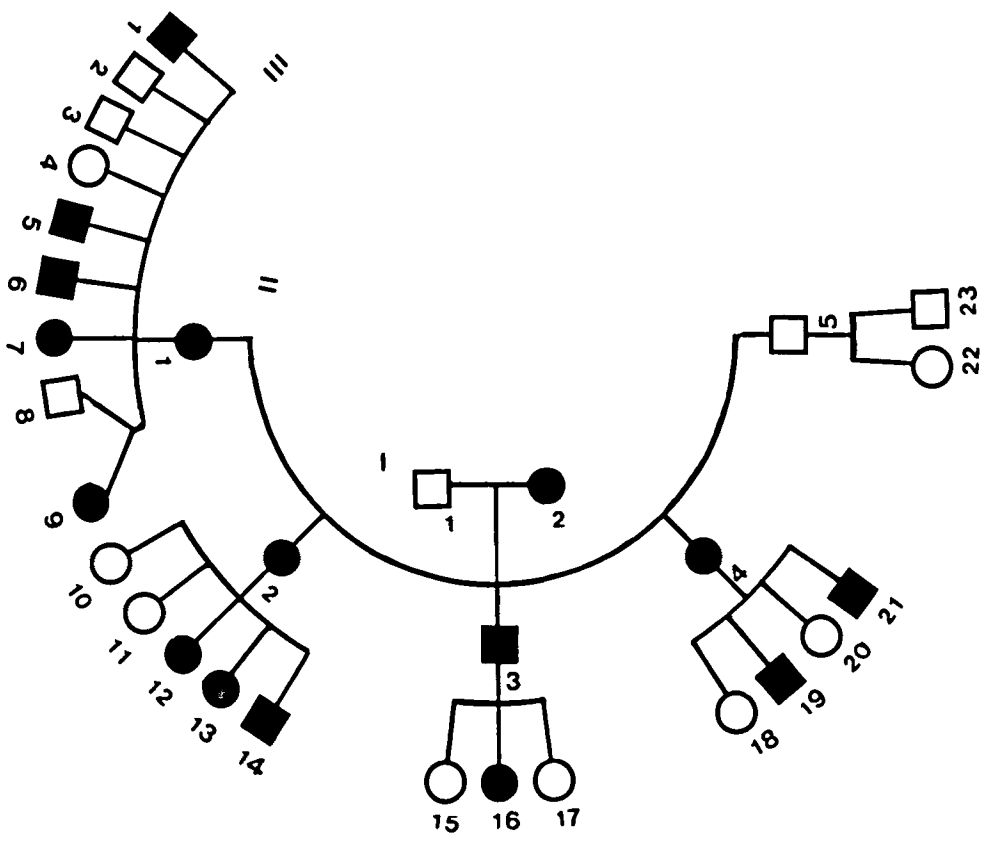

Fig. 1. Family pedigree.

was normal, but walking was slightly delayed at 16 months. Like her brother (case 1), her speech and language milestones were delayed. She had special education from the age of five years. At four years an educational psychologist reported that she was of average intellectual ability and she had good understanding of speech. Her drawing of a man was slightly above chronological age.

At five years, speech and language assessment showed that her comprehension was delayed by one year. She could combine two or three words (2 to 2½-year expressive language level). Her speech was unintelligible, as she had difficulty in organising and controlling speech movements.

A neurological examination at 5 years 4 months revealed no abnormal signs. She jumps, hops and is agile for her age. Her tongue was mobile when she was asked to move it from side to side, or in and out. Her OFC was 51·5cm (50th percentile). She was under the care of orthopaedic surgeons because of her spinal deformity, and wore a brace.

CASE 3

Z.N. (d.o.b. 14.5.82) is patient III_7 on the pedigree (Fig. 1). This girl is now six years of age and her dyspraxia is so severe as to make her unintelligible. She has problems in organising and controlling the movements necessary for speech, but also has expressive language delay and is unable to combine more than two or three words meaningfully. Her comprehension is two years delayed, but despite this she has always been considered to have potential cognitive ability at least in the average range. Her early milestones were slightly delayed, although she walked at 17 months. Speech has always been delayed and words were only attempted at the age of three.

CASE 4

A.Y. (d.o.b. 24.8.73) is patient III_{19} on the pedigree (Fig. 1). He is now 15 years old and his speech is often unintelligible. His expressive language is very delayed and has been described as 'disordered', although his comprehension is only slightly delayed. Early motor development was reasonably good, in that he walked at 18 months, and an educational psychologist reported that he had above-average intelligence. Throughout childhood, his reading age has been almost half his chronological age.

CASE 5

S.Y. (d.o.b. 29.7.82) is patient III_{21} on the pedigree (Fig. 1). A recent assessment of this six-year-old boy found that his speech was jerky and dysfluent because of dyspraxia, making his speech unintelligible. Expressive language is disordered,

and probably at a three-year level. He hs difficulty with word order and with finding words. An educational psychologist has reported that he is of average intelligence. His developmental history indicates that there have been delays only in the area of language.

CASE 6

C.W. (d.o.b. 28.8.77) is patient III_{12} on the pedigree (Fig. 1). This girl is of low-average intelligence. Her language is limited and disordered, and can be unintelligible. Her early milestones were normal, in that she sat at six months and walked at 15 months. She had no words at three years, although she vocalised while playing. She has attended a speech and language unit from the age of five, but despite extra help, she is still considerably dyspraxic.

Speech

The following is a summary of the main findings for four of these family members. Speech tended to be simplified, with poor awareness of appropriate sound patterns. Articulation was also defective, and they were considered to have a moderate to severe degree of dyspraxia. They could position the tongue and lips for simple movements, but failed when a sequence of movements was required. They also had a reduced use of consonant clusters, for example 'boon' for spoon and 'bu' for blue, and sound structure was simplified. They would also omit first sounds, *i.e.* 'able' for table, yet 'b' and 't' were used correctly in other words. In general there were few final sounds and polysyllabic words became monosyllabic or bisyllabic.

They took a long time to name pictures of objects with with they were familiar, and tended to use approximate words, for example 'glass' or 'tea' for cup, and 'sky' for star. Comprehension was also delayed, especially the understanding of comparatives. 'The knife is longer than the pencil' was poorly understood. 'The girl is chased by the horse' became 'the girl is chasing the horse', and 'the boy chasing the horse is fat' was interpreted as being the same as 'a thin boy chasing a fat horse'. Most of those affected, especially the children, could not retain three items in the correct sequence. Many were unintelligible and reluctant to offer spontaneous conversation.

Discussion

The affected members of this family all have the same type of speech and language difficulty, but to varying degrees of severity. The unaffected members have no speech and language difficulties and all attended normal schools. Of the 16 affected children, none had significant feeding difficulties as infants and there were few neonatal problems. Hearing and intelligence of all affected members were within the normal range.

The speech problem in this family has been classified as developmental verbal dyspraxia. There seems to be difficulty in organising and co-ordinating the high-speed movements necessary to produce intelligible speech. Speech and language assessments have also shown both expression and comprehension of speech to be delayed, with expression most severely affected. All have problems with articulation, and have difficulty in constructing grammatical sentences. No abnormal neurological signs were found in the limbs, but they cannot sign instead of talk as they are unable to organise signing. Dewey *et al.* (1988) have recently shown that children with verbal-sequencing defects of the type found in this family have difficulty in performing sequences of limb and oral gestures.

We know of no other reports of families with this specific abnormality of speech and language. Inheritance in this family is autosomal dominant, and chromosome analysis on one of the affected members was normal. No unaffected individuals have had affected children. The speech and language difficulties have improved to some extent with age.

The children are language-impaired rather than language-delayed. Unfortunately this is a heterogeneous group, which so far defied sub-classification (Bishop 1987). Indeed, this difficulty in identifying specific phenotypes has hampered genetic studies, and to date most work has been done on dyslexia and sex-chromosome abnormalities. The family presented here does not fall into either category and possibly represents a very unusual, dominantly inherited condition. Its importance seems to be that there is a single gene coding for a pathway which is fundamental for developing intelligible langauge.

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SUMMARY
A three-generation family is described in which 16 members have a severe developmental verbal dyspraxia. Inheritance is autosomal dominant, with full penetrance. Intelligence and hearing are normal.

RÉSUMÉ
Une famille étendue avec un trouble du langage hérité sur le mode dominant
Une famille est décrite sur trois générations, dans laquelle 16 membres présentaient une grave dyspraxie verbale de développement. La transmission est apparue de type autosomique dominant avec pénétrance totale. L'intelligence et l'audition était normales.

ZUSAMMENFASSUNG
Eine Großfamilie mit dominant vererbter Sprachstörung
Es werden drei Generationen einer Familie beschrieben, in der 16 Mitglieder eine schwere verbale Dyspraxie haben. Der Erbgang ist autosomal dominant mit voller Penetranz. Intelligenz und Gehör sind normal.

RESUMEN
Una gran familia con una alteración del lenguaje heredada de forma dominante
Se decribe una familia de tres generaciones en la cual 16 miembros han tenido una grave dispraxia verbal de desarrollo. La herencia es autosómica dominante con penetrancia completa. La inteligencia y la audición son normales.

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