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Short clinical report

Childhood apraxia of speech without intellectual deficit in a patient with cri du chat syndrome

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ABSTRACT

We report an 11-year-old girl for whom the diagnosis of cri du chat syndrome (CdCS) was made during a genetic investigation of childhood apraxia of speech. The patient presented with the classic chromosome 5 short arm deletion found in CdCS. The microdeletion, characterised using aCGH (array Comparative Genomic Hybridisation), was 12.85 Mb, overlapping the 5p15.2 and 5p15.3 critical regions. CdCS is typically associated with severe mental retardation while this patient had normal intellectual performance, confirmed by normal results from categorisation tasks. This mild phenotype was assessed using a comprehensive cognitive battery. Language evaluation showed normal receptive vocabulary scores, in contrast with obvious oro-facial dyspraxia. Disabled fine motor skills were confirmed as well as weak visuo-spatial reasoning abilities. In conclusion, fine cognitive assessment may be worthwhile for patients with CdCS since good intellectual functioning may be masked by severe speech and gestural dyspraxia, thus requiring specific teaching and rehabilitation strategies.

1. Introduction

Cri du chat syndrome (CdCS) was first described by Lejeune in 1963 [1]. This syndrome results from a deletion of chromatin from the short arm of chromosome 5 (5p). A *de novo* deletion is present in 85% of cases while 10–15% of cases are inherited from an unaffected parent with a balanced translocation or inversion. The prevalence is rare, at 1/50,000. Clinical features include vocal peculiarities with a typical and striking cat-like cry during the first year of life, psychomotor retardation [2], common severe mental retardation [3], failure to thrive, and craniofacial dysmorphisms [4] which include a round face, hypertelorism, epicanthal folds, down-slanting palpebral fissures, strabismus, broad nasal bridge, and micrognathia. The main behavioural problems are hyperactivity, loss of attention, uneasiness, and aggressive and self-injuring behaviour.

Childhood apraxia of speech (CAS), also called developmental verbal dyspraxia, is a language disorder affecting expressive modality. The definition differs according to different authors. For some authors, it is a form of dysphasia. The Committee on Apraxia of Speech in Children recommends the following definition for CAS [5]: "childhood apraxia of speech is a neurological childhood (paediatric) speech sound disorder in which the precision and consistency of movements underlying speech are impaired in the absence of neuromuscular deficits (*e.g.* abnormal reflexes, abnormal tone). CAS may occur as a result of known neurological impairment, in association with complex neuro-behavioural disorders of known or unknown origin, or as an idiopathic neurogenic speech sound disorder. The core impairment in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody". For other authors, childhood apraxia of speech is a form of dyspraxia affecting the programming of articulation.

Here, a case of CdCS is described in a girl with a relatively mild phenotype, without mental retardation but with language and gestural disorders fulfilling clinical criteria for CAS.

2. Case report

The proband was an 11-year-old girl, the third child of non-consanguineous parents. She was born at full term. The pregnancy was normal, and vaginal delivery took place without medical

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assistance. Birth weight was 2350 g, length 47 cm and head circumference 32 cm. Her cry at birth was high-pitched, but did not draw the attention of physicians. Her development was normal in the first year. She walked at one year. Language was delayed and she spoke her first words at three years. With speech therapy, language skills developed with major difficulty in articulation while receptive language was normal. The psychometric evaluation (K-ABC) performed at five years of age showed low scores; 62 in sequential processing and 58 in simultaneous mental processing. At that time, since mental retardation was suspected, she remained in kindergarten and a specialised section for disabled children was suggested but refused by the parents.

She was thus referred to the department of paediatric neurology for investigation of learning disorders. Neurological examination at six years and five months showed a nasal, slow dysarthric voice with oro-facial dyspraxia, impaired fine motor skills with synkinesis, bilateral intention tremor, and left arm dysmetria. The OFC was 49.4 cm (−1.5 SD). In contrast to the K-ABC scores, she performed better on the WPPSI-R (full-scale IQ: 75, verbal IQ: 76, non-verbal IQ; 76) and Raven's standard progressive matrices (25th centile), thus suggesting weak but not impaired intellectual abilities. Moreover, normal reasoning skills were displayed using the categorical analysis of the Intelligence Rating Scale EDEI-R [6] (resulting in an equivalent age of six years and two months, relative to an actual age of six years and nine months), which definitively ruled out mental retardation. This supported the parents' decision for her to remain in normal school. Language impairment, mainly oro-facial dyspraxia, associated with coordination disorders suggested the diagnosis of apraxia of speech. Electroencephalography and brain MRI were normal.

At 11 years old, the patient was in the fourth year of normal primary school. Specific pedagogy for dyspractic children was applied in the classroom. Reading was acquired in the second year of primary school, but writing difficulties persisted. On the WISC IV, Verbal Comprehension Index was 79 (Standard Score; Similarities: 8, Vocabulary: 5 and Comprehension: 6) and Perceptual Reasoning Index was 61 (Block Design 1, Picture Concepts 7, Matrix Reasoning 3). A Digit Cancellation Test and the computerised battery (KITAP; Table 1) showed difficulties in distractor inhibition and selective and sustained attention, as well as long inspection time and slow motor performance. DSM IV criteria for attention deficit disorder without hyperactivity were present. Forward and backward digit span scores were +2.6 SD and +1.5 SD, respectively. The patient had fine motor disorders; slow performance in the Ajuriaguerra writing speed test and impaired bimanual dexterity and coordination based on the Purdue Pegboard test (scores < −3 SD). The Rey Figure test showed major visuo-constructive problems, trembling and imprecise drawing with details of the whole picture difficult to recognise. The LOMDS (Table 1) showed global motor problems, slowness and clumsiness, fulfilling clinical criteria for a developmental coordination disorder. Oro-facial dyspraxia concerning mostly the cheek and mandible was exhibited using the Hénin–Dulac test (Table 1). Linguistic assessment with a comprehensive battery (Table 1) did not show any problems in phonological metacognition or receptive and expressive vocabulary. Conversely, verbal initiation was limited, and word and non-word repetition scores were very low. The high-pitched voice was noticed. She had mild dysmorphic features including micrognathia with dental malocclusion, up-slanting palpebral fissures, hypertelorism, epicanthal folds and hypoplasic alae nasae. Dysmorphic features had not been noticed earlier, probably because of the ethnic origin (the paternal family originated from Vietnam). She had no visceral malformation.

This complex developmental disorder prompted us to perform cytogenetic investigations including blood karyotype and aCGH which showed a 5p15.33-5p15.2 deletion of 12.85 Mb, expanding from base position 1 to 12,853,210 of the human genome version hg 18 (Fig. 1).

Table 1
Cognitive assessment of the patient tests references: **KITAP**, Zimmermann et al, test of Attentional performance for children, 2005; the **Rey figure**, Rey A., Test de copie d'une figure complexe, ECPA, Paris, 1960; **Purdue Pegboard**, Fleishman E.A., Ellison G. D., 1962; **LOMDS** (Lincoln-Oseretsky Motor Development Scale), Sloan W. and Roge B., ECPA, Paris, 1984; **PPVT** (Peabody Picture Vocabulary test-revised), Dunn, L.M., 1993; French version **EVIP** (Echelle de vocabulaire en images Peabody); **BALE**, Bilan analytique du langage écrit, Jacquier-Roux and colleagues, Laboratoire Cognisciences et Apprentissages, IUFM-Grenoble, 1999; **NEEL** (Nouvelles épreuves pour l'examen du langage), Chevrie-Muller C., ECPA, Paris, 2001; **ELO** (Examen du Langage Oral), Khomsi A., ECPA, Paris, 2001; **Hénin Dulac** test, Hénin N, Les cahiers d'ORL 1980, 15: 809-851.

Cognitive Function	Test	Score
Executive functions		
Attention	Alertness (RT, KITAP)	Percentile 1
	Distractibility (RT, KITAP)	Percentile 1
	Sustained attention (RT, KITAP)	Percentile 0
Short-term memory	Forward digit span	+2.60 SD
Working memory	Backward digit span	+ 1.54 SD
Motricity		
	Complex Rey figure	Percentile < 10
	Purdue pegboard (preferred hand)	−3 SD
	Purdue pegboard (minor hand)	−3.33 SD
	Purdue pegboard (both hands)	−3.64 SD
	Purdue pegboard (assembly)	−3.57 SD
	LOMDS	Percentile < 10
Language		
	PPVT (EVIP)	Standard Score: 112
	Rhyme judgment (BALE)	−1.83 SD
	Syllable suppression (BALE)	0.64 SD
	Initial phoneme suppression (BALE)	0.87 SD
	Final phoneme suppression (BALE)	−0.09SD
	Fusion phoneme (BALE)	−1.21 SD
	Phoneme segmentation (BALE)	−0.75 SD
	Verbal fluency (BALE)	−1.53 SD
	Word repetition (BALE)	−30.83 SD
	Non-word repetition (BALE)	−7.2 SD
	Auditory memory (NEEL)	−0.8 SD
	Lexical production (ELO)	Percentile > 90
	Oro-facial praxis (Hénin–Dulac)	oro-facial apraxia cut-off

3. Discussion

This case report describes a mild phenotype of CdCS using a comprehensive cognitive battery and illustrates the variability of the phenotype associated with the classic 5p deletion. This girl was referred to us for investigation of learning disorders and the diagnosis of CAS was made regarding the association of oro-facial and praxic disorders, which fulfilled the diagnostic criteria described in the technical report of the American Speech-Language-Hearing Association Ad Hoc Committee on Apraxia of Speech in Children[7,5].

CdCS is always associated with severe articulation disorders, with receptive language less affected than expressive language [4,8]. In large published series, expressive language ability rarely exceeds that of two years of age [9,10]. For instance, Cornish and colleagues [3] described 26 children with CdCS, aged between six years and four months and 15 years and five months. Their IQ was measured with the WISC III. The full-scale IQ of 21 children fell into the severe range of learning difficulty (IQ < 50); the IQs of the remaining five children were within the moderate range. Statistical analysis revealed no significant difference between the verbal and performance IQ means. In the present patient, vocabulary scores in