

Original article

Personality profile and health-related quality of life in adults with previous continuous spike-waves during slow sleep syndrome

Giovanna Lenci^a, Maria Grazia Calevo^b, Roberto Gaggero^c, Giulia Prato^{a,d,*},
Livia Pisciotta^a, Elisa De Grandis^{a,d}, Maria Margherita Mancardi^a,
Maria Giuseppina Baglietto^{a,d}, Monica Vigano^a, Edvige Veneselli^{a,d}

^a Unit of Child Neuropsychiatry, Dept of Clinical and Surgical Neurosciences and Rehabilitation, IRCCS Istituto Giannina Gaslini, Genoa 16147, Italy

^b Epidemiology and Biostatistics Section, Scientific Directorate, IRCCS Istituto Giannina Gaslini, Genoa 16147, Italy

^c Pediatric Unit, San Paolo Hospital, Savona 17100, Italy

^d Dept. of Neurosciences, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health (DiNOGMI), University of Genoa, Italy

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Abstract

Introduction: Epilepsy with continuous spike-waves during slow sleep syndrome (CSWSS) is characterized by various seizure types, a characteristic EEG pattern and neuropsychological disorders. The main purpose of this study was to evaluate the long-term outcome of CSWSS occurred in childhood and to evaluate the variables that could influence the quality of social adaptation and the personality profile.

Material and methods: This is a prospective study on 24 young adults with previous CSWSS (median age 24.5 yrs) who were enrolled between January and July 2011 at the G. Gaslini Children's Hospital, Genoa, Italy. Patients were divided into two groups: twelve with previous spike-wave index (SWI > 85%) defined as typical CSWSS (T-CSWSS) and twelve with previous SWI = 50–85% defined as atypical CSWSS (A-CSWSS). All the subjects were submitted to Minnesota Multiphasic Personality Inventory-2 (MMPI-2), Psychological General Well-Being Index (PGWBI), and to a structured interview.

Results: A correlation was observed with the severity of EEG abnormalities expressed by the SWI and outcome. The T-CSWSS group showed a significantly lower perceived well-being. Similarly in the T-CSWSS group the percentage of MMPI-2 clinical scales with *T*-scores ≥ 65 was higher than in the A-CSWSS group. Finally, a significant lower schooling in the T-CSWSS group was observed.

Conclusion: There seem to be two forms of the same disease, with similar onset and clinical evolution but a different outcome regarding the social and psychological conditions. The outcome of the social adaptation and of the personality consciousness was related with the severity of the EEG abnormalities: more favorable in patients with less intense SWI activity (A-CSWSS) compared those with a more severe EEG impairment (T-CSWSS).

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Keywords: Continuous Spike-Waves During Slow-Wave Sleep Syndrome (CSWSS); Outcome; Young adult; Minnesota Multiphasic Personality Inventory-2 (MMPI-2); Psychological General Well-Being Index (PGWBI); Spike-Wave Index (SWI)

* Corresponding author at: Dept. of Neurosciences, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health (DiNOGMI), University of Genoa, Italy.

E-mail address: giulia_prato@hotmail.com (G. Prato).

1. Introduction

Epilepsy with continuous spike-waves during slow sleep syndrome (CSWSS) is associated with various sei-

zure types (partial or generalized, occurring during sleep, and atypical absences when awake), a characteristic EEG pattern of continuous spike-waves during slow wave sleep and neuropsychological disorders [1].

It represents 0.5% of all childhood epilepsies [2] and it lasts usually several years. CSWSS is characterized by a benign electroclinical prognosis, with a spontaneous resolution in the second decade of life [3].

CSWSS can be apparently idiopathic (as atypical evolution of benign childhood epilepsy with centrotemporal spikes) or secondary to brain developmental or acquired abnormalities (i.e. dysplasia, polymicrogyria) [1].

The EEG pattern is called “Electrical Status Epilepticus During Sleep” (ESES), which is characterized by the presence of continuous spike and wave complexes with spike-wave index (SWI) ranging from 85 to 100% [1].

Typical EEG findings are characterized by continuous epileptiform activity occupying more than 85% of non-rapid eye movement (NREM) sleep and persisting in at least three EEG recordings over a period of at least 1 month [4–7]. The cases with SWI <85% are considered as atypical-CSWSS [4].

During the evolution, neuropsychological impairment, in the form of global or selective regression of cognitive functions, and motor symptoms as ataxia, dys-tonia, and unilateral deficit, occur [1].

The pattern of psychological and behavioral disorders associated with CSWSS has been a matter of great interest for decades, especially with regard to prognosis [3,7,8].

A review of the literature showed that the neuropsychological functions are the most impaired and that, in acute CSWSS, there may be a decline in overall intelligence quotient (IQ), with impairment of performance and verbal items, space-time disorientation, attention impairment, and behavioral changes such as hyperactivity, aggressiveness, isolation and, in rare cases, psychosis [9–11].

Several different factors have been evaluated in relation with neuropsychological, psychiatric and social outcomes. Regarding the severity of EEG abnormalities' effects (frequency and distribution in NREM sleep), previous studies showed a minor cognitive impairment in atypical CSSWS [4].

Moreover, Van Hirtum-Das and colleagues confirmed the presence of impairment even in patients with SWI = 50–85% [12].

Duration and early onset of CSWSS are poor prognostic factors for neuropsychological development [2], therefore late recognition of clinical symptoms (especially EEG pattern) and absent or delayed administration of therapy may adversely affect prognosis.

After the remission of CSSWS, neuropsychological [11] and behavioral residual disorders can be observed

such as hyperactivity, inattention, anxiety, phobias, aggression, and autistic features [3,12]. Few studies have investigated the adult social and psychiatric outcome [3,8].

After the disappearance of CSWSS, patients may show improvement both in cognitive and language performances. However, long-term prognosis is not favorable in about 50% of cases. The clinical picture is generally characterized by deficits in all cognitive functions with heterogeneous profiles, presumably related to the localization of paroxysmal EEG abnormalities [1]. These patients can find difficulties in social integration [8], or they can show attention deficit, hyperactivity, language deficit and affective symptoms [1].

No study was dedicated to quality of life, social adaptation, and personality profile in patients with previous CSWSS without other neurological and mental impairment.

So, the main purpose of this study was to evaluate the outcome of CSWSS in adult age using measures such as personality profile and quality of life (QoL). Other aim of the discussion was to evaluate if onset age, CSWSS duration, and severity Spike Wave Index (SWI) could influence the quality of social adaptation and the personality profile.

2. Methods

This is a prospective study and it was carried out between January and July 2011 at the G. Gaslini Children's Hospital, Genoa, Italy. In the Epilepsy Center of the Department of Child Neuropsychiatry 35 patients were recruited from a cohort of patients with a clinical diagnosis of CSSWS received between January 1985 and September 2009.

To be eligible for this study the patients had to have (i) a clinical diagnosis of CSWSS according to the criteria established by the Commission on Classification and Terminology of the International League Against Epilepsy [13], (ii) evidence of persistent remission of the electroencephalographic pattern during sleep (SWI <20%) for more than 3 years, (iii) age at beginning of the study >18 years, (iv) minimum 10-year schooling, (v) and had to be Italian native speakers, able to give consent, and able to understand psychological test instructions (Minnesota Multiphasic Personality Inventory-2 – MMPI-2, Psychological General Well-Being Index – PGWBI).

In all the patients an IQ was measured by Wechsler Intelligence Scale at the moment of the CSWSS syndrome diagnosis and each 1–2 years until remission. The total IQ (T-IQ), the verbal IQ (V-IQ) and the Performance IQ (P-IQ) obtained by the Wechsler Intelligence Scale were considered and three different profiles were distinguished: a) harmonic with differences

between V-IQ and P-IQ < 15; b) verbal impairment with difference P-IQ > V-IQ exceeding 15; performance impairment with V-IQ > P-IQ exceeding 15 [14].

The patients with an initial total IQ < 70 and those with brain abnormalities were excluded.

The initial CSWSS diagnosis was based on a 24-hour ambulatory EEG confirmed by an all-night polygraphic recording. During the evolution, monitoring was performed by means of ambulatory EEG.

For each eligible patient, informations were retrieved from the institutional database and clinical records and they included demographics data, age at onset, age at regression, type and frequency of seizures at onset, IQ at onset and at remission. Results of Magnetic Resonance Imaging (MRI) were also reviewed.

Of the 35 identified subjects, 30 met all inclusion criteria. Six patients were not being included in the study since they could not be reached by telephone or mail ($n = 3$), or no complete clinical data were available ($n = 1$), or they declined to participate for personal reasons ($n = 2$). Twenty-four agreed to give informed consent.

Twelve (50%) were females. Their median age at follow up was 24.5 years, ranging from 18 to 31.6 years. Median age was 5 years, (range 2.7–9.3 years) at epilepsy onset and 7.2 years (range 3.5–12.2 years) at CSWSS onset. The latency between epilepsy onset and CSWSS onset was 1.5 years (0.25–7 yrs). In 75% of our population, before onset of CSWSS the frequency of seizures was yearly or sporadic. During the active phase, seizure frequency increased in 8 cases, unchanged in 14, whereas two patients did not present seizures did never present seizures during the course of disease. In all the cases, therapy was started after the second seizure or after the CSWSS diagnosis. Therapy was firstly valproic acid (VPA), associated later with other antiepileptic drugs (ethosuccimide; ESM, lamotrigine; LTG) in 8 patients. Subsequently, cycles of Benzodiazepines (diazepam DZP, clobazam CLB) were employed in all cases, with a positive clinical and EEG response in 19 (79%) [15]. In five non-responders, also steroids cycles were administered [16]. In all patients, therapy was discontinued only after CSWSS remission. All the evaluations were performed under treatment. The median disease duration was 3.2 years (range 0.8 months – 13 years). Median age at remission was 10 years (range 4–18 years).

Patients were divided into two groups according to the EEG features: cases with SWI > 85% during nocturnal sleep persisting at least for 3 months were classified as Typical-CSWSS group (T-CSWSS), whereas patients showing a 50–85% SWI were considered as Atypical-CSWSS group (A-CSWSS). The T-CSWSS included twelve patients (50%) and the A-CSWSS twelve patients (50%).

2.1. Procedure

All subjects were contacted by phone and were asked to be followed at our department.

During the follow up, all subjects filled out MMPI-2, “Psychological General Well-Being Index” (PGWBI) questionnaires and a socio-demographic structured interview in a single session. The patients completed the questionnaires in the presence of an expert (G.L.), who could assist them in case of difficulties in understanding the questions, but did not influence the answers.

The study was approved by the Institutional Review Board of the G. Gaslini Institute, Genoa, Italy. All patients gave their informed consent.

3. Measures

3.1. Minnesota Multiphasic Personality Inventory-2

The Minnesota Multiphasic Personality Inventory-2 (MMPI-2) is one of the most common tests used to assess the main psycho-pathological characteristics of personality. The MMPI-2 consists of 567 “true–false” items that are grouped into 10 basic clinical and 3 validity scales. The clinical scales that assess the most significant personality traits of candidates include: Hypochondria (Hs), Depression (De), Hysteria (Hy), Psychopathic Deviate (Pd), Masculinity/femininity (M/f), Paranoia (Pa), Psycho-asthenia (Pt), Schizophrenia (Sc), Hypomania (Ma), and Social Introversion (Si). The validity scales (L, F, and K) assess the extent to which the candidate filled out the questionnaire truthfully and accurately. The Italian version was utilized for this study [17].

For this study, we took into account validity scales and clinical scales, considering as cut-off t -scores ≥ 65 in according to interpretation manuals [18].

The MMPI-2 protocols were interpreted also according to the “two-point code,” which distinguishes the two MMPI-2 clinical scales with the highest T scores. In each patient the 2 or 3 higher scales (≥ 65) define specific psychopathological disorders. The cases with a single elevated scale are considered as a “spike” configuration. Each “two-point” code corresponds to distinct personality characteristics as described in the MMPI-2 manual [19].

4. The Psychological General Well-Being

The Psychological General Well-Being Index (PGWBI) is a generic health-related quality of life (HRQoL) instrument [20]. It is a self-assessment inventory of affective or emotional states during the previous week with 22 items (0–5) divided into six subscales: Anx-

xiety, Depressed mood, Positive Well-being, Self-control, General Health, and Vitality. A high score represents better outcome. Total scores range from 0 (extreme distress) to 110 (optimal well-being). Total scores between 0 and 60 represent severe distress, between 61 and 72 moderate distress, and ≥ 73 positive well-being. PGWBI has good evidence supporting internal consistency, test-retest reliability and validity [20,21]. The Italian version of the questionnaire was utilized for this study [22].

5. Socio-demographic structured interview

A structured interview was designed to collect socio-demographic data: a) level of education (primary school, middle school, high school, or university degree), b) employment status (stay-at-home or working or student), c) civil status and d) residence (living alone or with parents).

5.1. Statistical analysis

Data were described as means, standard deviation (SD) and medians with range for continuous variables, while absolute and relative frequencies were used for categorical variables.

Parameters of the study groups were compared using χ^2 or Fisher exact test for categorical variables.

The comparisons among continuous variables were carried out using non-parametric methods (Mann-Whitney test, Kruskal Wallis test). Moreover, Wilcoxon test was used for paired data to evaluate changes in variables at different times.

Regression analyses were used to verify the hypothesis that age of onset and disease duration could be associated with quality of social adaptation and personality profile.

A p-value less than 0.05 was considered statistically significant, and all p-values were based upon two tailed tests.

Statistical analysis was performed using SPSS for Windows (SPSS Inc, Chicago, Illinois USA).

6. Results

Detailed clinical histories of our 24 patients are shown in Table 1.

Concerning the two groups, identified according to the SWI (Typical-CSWSS and Atypical-CSWSS), not significant differences in age at onset of epilepsy, age at onset of CSWSS, age at remission, and CSWSS duration were observed (Table 1) (4.6 ± 1.5 vs 5.7 ± 1.8 , $p = 0.11$; 7.1 ± 2.5 vs 7.3 ± 1.6 , $p = 0.87$; 11.7 ± 3.3 vs 10.3 ± 1.6 , $p = 0.22$ and 4.5 ± 3.2 vs 3.1 ± 1.5 , $p = 0.16$ respectively, Table 1).

Table 1

Characteristics of patients with CSWSS – Heach clinical data was not different between T-CSWSS and A-CSWSS groups.

Clinical data	All	T-CSWSS	A-CSWSS	p value
Number of patients	24	12	12	
Sex F/M	12/12	7/5	5/7	0.68
	Mea n \pm SD	Mea n \pm SD	Mea n \pm SD	
	Median (range)	Median (range)	Median (range)	
Age at epilepsy onset, yrs	5.2 ± 1.7 5 (2.7–9.3)	4.6 ± 1.5 4.6 (2.7–8.2)	5.7 ± 1.8 5.8 (3.3–9.3)	0.11
Age at onset CSWSS, yrs	7.2 ± 2 7.2 (3.5–12.2)	7.1 ± 2.5 6.2 (3.5–12.2)	7.3 ± 1.6 7.2 (4.3–9.7)	0.87
Latency, yrs	2 ± 1.6 1.5 (0.25–7.1)	2.5 ± 2.1 1.4 (0.25–7.1)	1.5 ± 0.8 1.5 (0.33–3.6)	0.14
Age at recovery, yrs	11 ± 2.6 10.7 (4.4–18)	11.7 ± 3.3 12.2 (4.4–18)	10.3 ± 1.6 10.4 (8.1–13)	0.22
Disease Duration, yrs	3.8 ± 2.5 3.2 (0.8–12.9)	4.5 ± 3.2 3.3 (0.9–12.9)	3.1 ± 1.5 3 (0.8–6)	0.16
IQ at onset	86.5 ± 9.3 87.5 (74–107)	84.4 ± 7.7 86 (74–97)	88.7 ± 10.6 89 (75–107)	0.27
IQ at recovery	100.8 ± 11.3 103.5 (79–121)	96.8 ± 11 97.5 (79–113)	104.7 ± 10.6 105 (85–121)	0.33
Szrs frequency				
<3/yr, N (%)	16	6	10	0.19
>50/yr N (%)	3	2	1	
Daily N (%)	5	4	1	

Latency: time from epilepsy onset until CSWSS diagnosis.

Age at Recovery: moment of remission of CSWSS syndrome.

Disease Duration: from CSWSS diagnosis until remission.

IQ at onset: IQ at the CSWSS diagnosis.

IQ at recovery: IQ at the CSWSS remission.

The seizure frequency was 1–3/year in 14, >50/year in 3, daily in 5, no seizures in 2. Seizures were generalized in 9, partial in 6, partial with secondary generalization in 2, partial and atypical absences in 5. Moreover, there were no real differences for frequency of seizures in the two, as $P = 0.19$ was not significant. At remission, the severity of the EEG abnormalities was mildly different in the two groups: a complete remission of the EEG abnormalities in 9 out of 12 cases with A-CSWSS (75%) versus 3 out of 12 in the T-CSWSS group (16.7%) ($p = 0.04$).

Each clinical data was not different between T-CSWSS and A-CSWSS groups.

Not significant differences between the two groups were observed in IQ scores both at onset (84.4 ± 7.7 vs 88.7 ± 10.6 , $p = 0.27$) and at remission (96.8 ± 11 vs 104.7 ± 10.6 , $p = 0.33$). We observed an evident improvement between the CSWSS onset (T0) and one year after CSWSS resolution (TI) in both groups (Table 2).

We report, in Table 2, T-IQ, V-IQ, P-IQ of all patients at onset of CSWSS (T0) and after one year of follow-up after resolution (TI). These data show that the profiles are harmonic in the majority of cases in both the groups without significant differences between T-CSWSS and A-CSWSS (Table 2).

Socio-demographic data at follow up are showed in Table 3. With regard to educational level, 87.5% ($N = 21$) had attended high school while 8.3% ($N = 2$) had attended primary school and 1 subject had a university degree.

Concerning occupational status, 41.6% were working, 29.2% were non-working and 29.2% were students. No one was married and only 2 subjects lived alone. A significant difference between the two groups was observed only in schooling (14.5 ± 2.6 yrs in the A-CSWSS group vs 12.7 ± 0.98 yrs in the T-CSWSS group; $p = 0.03$).

Concerning occupational status, 16.7% of the subjects were non-working in the A-CSWSS group versus

Table 2
 IQ at onset and one year after recovery of all patients.

	T-IQ T0	V-IQ T0	P-IQ T0	T-IQ TI	V-IQ TI	P-IQ TI
T-CSWSS group						
1	91	96	103	100	105	91
2	70	86	109	97	114	70
3	79	100	92	82	106	79
4	71	78	79	73	82	71
5	105	119	105	96	117	105
6	89	90	113	110	115	89
7	105	93	105	95	108	105
8	83	95	92	86	97	83
9	77	80	87	85	92	77
10	87	83	105	116	95	87
11	67	80	87	86	91	67
12	88	78	85	91	81	88
Mean \pm SD	84.3 ± 12.5	89.8 ± 11.9	96.8 ± 11.1	93.1 ± 12	100.3 ± 12.4	84.3 ± 12.5
A-CSWSS group						
1	107	95	125	108	98	118
2	75	70	77	85	86	88
3	86	84	87	104	101	104
4	83	79	80	106	92	103
5	107	105	109	121	117	123
6	95	93	96	121	115	126
7	75	80	71	106	110	99
8	87	101	75	85	92	81
9	72	62	86	97	102	92
10	88	77	104	92	80	109
11	90	87	90	102	106	101
12	90	84	100	113	103	123
Mean \pm SD	87.9 ± 11.3	84.7 ± 12.4	91.7 ± 15.8	103.3 ± 12	100.2 ± 11.2	105.6 ± 14.6

T-IQ, V-IQ and P-IQ of all patients at onset of CSWSS (T0) and after one year of follow-up after resolution (TI).

At T0:

Harmonic Profile (Differences between V-IQ and P-IQ < 15) in 16 cases; Verbal Impairment (Differences between V-IQ < P-IQ exceeding 15) in 7 cases; Performance Impairment (Differences between V-IQ > P-IQ exceeding 15) in one case.

At TI:

Harmonic Profile (Differences between V and IQ and P-IQ < 15) in 18 cases; Verbal Impairment (Differences between V-IQ < P-IQ exceeding 15) in 3 cases; Performance Impairment (Differences between V-IQ > P-IQ exceeding 15) in 3 cases.

41.7% in the T-CSWSS group, though if there is no statistical difference.

The results of the MMPI-2 test are presented in Table 4. The scores of validity scales L, F, K resulted under cut-off ≥ 65 (Table 4). Also the mean scores of the MMPI-2 clinical scales were within normal limits (under cut-off ≥ 65). We observed that the scores were higher (more severe impairment) in the T-CSWSS group for almost all MMPI-2 clinical scales. The differences between T-CSWSS group and A-CSWSS group were Hypochondria (Hs) (56.8 ± 10.5 vs 46.8 ± 6.9 ; $p = 0.02$), Depression (De) (62.2 ± 11 vs 47.7 ± 9.9 $p = 0.005$), Hysteria (Hy) (55.3 ± 12.8 ; 44.8 ± 6.3 $p = 0.03$), Psychopathic Deviate (Pd) (60.7 ± 8.3 vs 52.3 ± 3.9 $p = 0.006$), Paranoia (Pa) (60.2 ± 10.2 vs 44.4 ± 8.9 $p = 0.001$), Psycho-asthenia (Pt) (60.8 ± 10.4 vs 44.6 ± 9.5 $p = 0.0001$), Schizophrenia (Sc) (61.3 ± 7.6 vs 52.9 ± 8.1 $p = 0.1$), Hypomania (Ma) (57.2 ± 7.9 vs 47.5 ± 9.2 $p = 0.005$).

Moreover, considering all the group, the results in single clinical scales showed values exceeding the cut off (≥ 65). In particular 41.7% in the M/f (Masculinity/femininity) scale, 33.3% in the De (Depression) and Pt (Psycho-asthenia) scales, 25% in the Sc (Schizophrenia) and Si (Social Introversion) scales, 20.8% in the Hs (Hypochondria) scale, 16.7% in the Pa (Paranoia) and Ma (Hypomania) scales and, 12.5% in the Hy and Pd scales (Table 5).

However, in the T-CSWSS group the percentage of MMPI-2 clinical scales with *T* scores ≥ 65 was higher than in the A-CSWSS group (Table 5). In particular, scores were significantly higher in Depression (De) (58.3% vs 8.3%, $p = 0.03$), Hypochondria (Hs) (41.7% vs 0%, $p = 0.04$), and Psycho-asthenia (Pt) (58.3% vs 8.3%, $p = 0.03$).

Finally, MMPI-2 protocols were examined using the “two-point code type” (Table 6). In the T-CSWSS group,

Table 4
Scores of MMPI-2 Test in our population.

Scales	All mean \pm SD	T-CSWSS mean \pm sd	A-CSWSS mean \pm sd	p value
L	55.1 \pm 6.5	56.3 \pm 5	53.9 \pm 7.7	0.37
F	54.8 \pm 7.6	57.7 \pm 7.3	51.9 \pm 6.9	0.06
K	45.6 \pm 6.3	44.9 \pm 4.3	46.2 \pm 7.9	0.61
1- Hs	51.8 \pm 10	56.8 \pm 10.5	46.8 \pm 6.9	0.01
2- De	54.9 \pm 12.6	62.2 \pm 11	47.7 \pm 9.9	0.003
3- Hy	50 \pm 11.2	55.3 \pm 12.8	44.8 \pm 6.3	0.02
4- Pd	56.5 \pm 7.7	60.7 \pm 8.3	52.3 \pm 3.9	0.005
5- M/f	59.8 \pm 11.7	57.2 \pm 9.3	62.5 \pm 13.6	0.27
6- Pa	52.3 \pm 12.4	60.2 \pm 10.2	44.4 \pm 8.9	0.001
7- Pt	52.7 \pm 12.8	60.8 \pm 10.4	44.6 \pm 9.5	0.001
8- Sc	57.1 \pm 8.8	61.3 \pm 7.6	52.9 \pm 8.1	0.01
9- Ma	52.3 \pm 9.7	57.2 \pm 7.9	47.5 \pm 9.2	0.01
0- Si	56.6 \pm 8.9	58 \pm 8.5	55.2 \pm 9.4	0.46

Hs: Hypochondria; De: Depression; Hy: Hysteria; Pd: Psychopathic Deviate; M/f: Masculinity-Femininity; Pa: Paranoia; Pt: Psychasthenia; Sc: Schizophrenia; Ma: Hypomania; Si: Social Introversion.

The results of the MMPI-2 test are presented in this table. The mean scores of the MMPI-2 clinical scales were within normal limits (50–59: personality traits; cut-off >65 : psychopathological traits). Statistically significant results are in bold.

75% of subjects presented a “*Floating Profile*” configuration, i.e. with clinical elevations on many scales, 8.3% presented a “*Spike 5*” configuration, i.e. with an elevation of Masculinity/femininity scale (M/f), and 17.7% had a “*Within-Normal-Limit*” configuration i.e. a profile lacking pathological values. In the A-CSWSS group, 41.7% of cases had a “*Within-Normal-Limit*” configuration, 50% “*Spike 5*”, and 8.3% (a single case) an elevated Depression scale (De) defined “*Spike 2*”.

The PGWBI scales and the global Index are shown in Table 7. In all the group, the mean scores in the PGWBI scales were in the range of positive well-being [22]. In the T-CSWSS group, the Global index was in the range of moderate distress and the scores showing a perceived

Table 3
Characteristics of patients with CSWSS – Socio-demographic data.

Socio-demographic data	All N (%)	T-CSWSS N (%)	A-CSWSS N (%)	P value
Education:				0.59
Middle school	2 (8.3)	1 (8.3)	1 (8.3)	
High school	21 (87.5)	11 (91.7)	10 (83.3)	
University degree	1 (4.2)	–	1 (8.3)	
Schooling, yrs Mean \pm SD	13.6 \pm 2.1	12.7 \pm 1	14.5 \pm 2.6	0.03
Occupational Status:				0.40
Not Working	7 (29.2)	5 (41.7)	2 (16.7)	
Student	7 (29.2)	3 (25)	4 (33.3)	
Working	10 (41.6)	4 (33.3)	6 (50)	
Not Married	25 (100)	12 (100)	12 (100)	
Residence				0.48
Living alone	2 (8.3)	2 (16.7)	–	
With parents	22 (91.7)	10 (83.3)	12 (100)	
Age at test median (range)	24.5 yrs (18–31.6)	24.5 yrs (18–31.6)	24.4 yrs (21.8–27.6)	0.99

Socio-demographic data at follow up revealed statistically significant results about schooling. Statistically significant results are in bold.

Table 5
MMPI-2 Clinical scales with scores $T \geq 65$.

Clinical Scales	All N° (%)	T-CSWSS N° (%)	A-CSWSS N° (%)	p value
1 - Hs	5 (20.8)	5 (41.7)	0	0.04
2 - De	8 (33.3)	7 (58.3)	1 (8.3)	0.03
3 - Hy	3 (12.5)	3 (25)	0	0.22
4 - Pd	3 (12.5)	3 (25)	0	0.22
5 - M/f	10 (41.7)	4 (33.3)	6 (50)	0.68
6 - Pa	4 (16.7)	4 (33.3)	0	0.09
7 - Pt	8 (33.3)	7 (58.3)	1 (8.3)	0.03
8 - Sc	6 (25)	5 (41.7)	1 (8.3)	0.16
9 - Ma	4 (16.7)	3 (25)	1 (8.3)	0.59
0 - Si	6 (25)	4 (33.3)	2 (16.7)	0.64

Hs: Hypochondria; De: Depression; Hy: Hysteria; Pd: Psychopathic Deviate; M/f: Masculinity-Femininity;

Pa: Paranoia; Pt: Psychastenia; Sc: Schizophrenia; Ma: Hypomania; Si: Social Introversion

In the T-CSWSS group the percentage of MMPI-2 clinical scales with T scores ≥ 65 (cut-off) was higher than in the A-CSWSS group. Statistically significant results are in bold.

Table 6
MMPI-2 two-point code type configuration.

	T-CSWSS N° (%)	A-CSWSS N° (%)
Within-Normal-Limit	2 (17.7%)	5 (41.7%)
Spike 2	–	1 (8.3%)
Spike 5	1 (8.3%)	6 (50%)
Floating profile	9 (75%)	–

MMPI-2 protocols were examined using the “two-point code type”.

well-being were significantly lower compared with the A-CSWSS group, both for the Global index (67.5 ± 11.4 vs 85.3 ± 13.7 ; $p = 0.004$) and for the single scale scores. In particular Anxiety (16.2 ± 3.8 vs 19.9 ± 3.5 ; $p = 0.02$); Depressed Mood (9.9 ± 2.1 vs 13.4 ± 2.2 ; $p = 0.001$); Positive well-being (9.9 ± 3.21 vs 13.3 ± 3.3 ; $p = 0.02$); General health (9.6 ± 2.1 vs 12.7 ± 1.5 ; $p = 0.0001$); Vitality (11.9 ± 2.8 vs 14.2 ± 3.6 ; $p = 0.03$).

Finally, the results of MMPI-2 and of PGWBI scales were not correlated with gender, age at onset and CSWSS duration.

7. Discussion

This study represents one of the few follow-up studies focusing on young adults with a previous CSWSS occurred in childhood, not only from an electrophysiological point of view, but also from a neuropsychological and psychosocial one. Our sample was reviewed from the first manifestations of seizures, before the onset of CSWSS, to date. Only non-symptomatic cases were considered, with the aim of avoiding the effects of primary etiological factors on outcome.

In agreement with literature data [2,11], our sample of CSWSS cases, show a complete clinical remission at the average age of 11 years both in T-CSWSS and in A-CSWSS.

The EEG outcome appears significantly different in two groups, the complete remission of EEG abnormalities was observed in most A-CSWSS subjects, while EEG abnormalities remained mild or moderate in most T-CSWSS subjects.

As other authors [1], we observed in all patients a mild cognitive impairment during the course of the syn-

Table 7
Scores of Health-related Quality of Life (PGWBI Test) in our population.

Scales	All mean \pm sd	Normal	T-CSWSS mean \pm sd	A-CSWSS mean \pm sd	p value
Anxiety	18 ± 4.1	17.2 ± 4.7	16.2 ± 3.8	19.9 ± 3.5	0.02
Depressed mood	11.7 ± 2.8	12.9 ± 2.5	9.9 ± 2.1	13.4 ± 2.2	0.01
Positive well-being	11.6 ± 3.63	12.4 ± 4.1	9.9 ± 3.2	13.3 ± 3.3	0.02
Self-control	10.9 ± 2.5	12.7 ± 2.5	10 ± 2.3	11.7 ± 2.4	0.08
General health	11.2 ± 2.4	11.9 ± 2.8	9.6 ± 2.1	12.7 ± 1.5	0.0001
Vitality	13 ± 3.4	13.8 ± 3.9	11.9 ± 2.8	14.2 ± 3.6	0.01
Global index	76.4 ± 15.3	80.9 ± 3.4	67.5 ± 11.4	85.3 ± 13.7	0.002

Global index ≥ 73 : positive well-being; 61–72: moderate distress.

In all the group the global index and the single scales were in the normal range. In the T-CSWSS group, the scores showing a perceived well-being were significantly lower (both total scores and each single scale score). Statistically significant results are in bold.

drome and a cognitive recovery at remission. With regard to cognitive features, our data show in all the cases a mean T-IQ around the low limits of the normal range at onset of CSWSS and an improvement at the moment of recovery, in agreement with the literature [11].

Concerning social-demographic data and the Quality of Life, our results show, according with Giovanardi Rossi et al. [8], that many patients presented difficulty in social and occupational integration and a tendency to describe themselves as slightly more depressed and less positive than their “healthy” peers. The MMPI-2, used to evaluate the personality profile, appears a reliable instrument as the validity scales showed normal values; the subjects were collaborative and consistent in the execution of the test, with no attempt to offer positive and socially acceptable self-images.

In agreement with previous studies examining behavioral outcomes in adults recovered from CSWSS [3,23] we observed some differences among single MMPI-2 profiles, with often pathological clinical scales.

The T-CSWSS group showed a worse personality profile (MMPI-2) compared to the A-CSWSS group. In particular, in the T-CSWSS group, we observed in all clinical scales a higher percentage of pathological t-score, that was statistically significant in Hypochondria (Hs), Depression (De) and Psycho-asthenia (Pt) scales.

Besides, MMPI-2 code-type interpretation [18] highlighted different specific configurations within the two groups. In 75% of T-CSWSS subjects, we observed a “Floating Profile” characterized by pathological elevation on almost all clinical scales with few inter-scale differences. The cases with a “Floating Profile” often show a multiple and polymorphous psychic symptomatology as well as inability to maintain a consistent image of oneself. On the contrary, in 41,7% of the A-CSWSS group, a “Within-Normal-Limit” configuration was detected (in this with a profile no clinical scale score exceeded the pathological cut-off), while the remaining half showed a “Spike 5” configuration, consisting in an elevation on scale 5 (Masculinity/femininity) only. In these patients however no symptoms of anxiety nor other emotional impairments were evident.

Concerning QoL, we observed a worse QoL in the T-CSWSS group, with signs of moderate distress and social adaptation in terms of schooling and occupational status, with unemployment levels exceeding five times the national average scores [24,25].

Unlike what is highlighted in the literature [2], in our study neither early onset nor longer duration of the syndrome (CSWSS) seemed to be the main predictors of “poor outcome” from the social and psychological point of view, but rather the severity of the EEG abnormality, expressed by the SWI, was important.

So according with our data, the psychological and social differences observed were correlated only with

the intensity of the EEG activity. Some hypothesis on the possible neurobiological factors involved in determining a worse psychological and social outcome in the group with T CSWSS compared with A CSWSS.

The CSWSS syndrome is associated with localized abnormal cerebral perfusion [26] and with metabolic focal changes [27]. Recently it has been demonstrated that the neurophysiological effects of CSWS activity are not restricted to the epileptic foci, but that their influences spread to the remote connected areas. These results suggest that the reversible remote effects participate to the functional effects of the CSWS activity [28]. Moreover, growth disturbance of prefrontal lobe volume, particularly prefrontal-to-frontal lobe volume ratio, have been shown by MRI studies after the appearance of CSWSS [28]. So, it can suggest that the more intense and continuous EEG abnormalities are associated with some severe functional dysfunctions of the cortical areas, that can be the cause of a long term psychic impairment.

Our study suggest that the degree of EEG abnormalities, in terms of SWI rather than age of onset, duration of CSWSS and frequency of seizures, could be considered a discriminating prognostic factor for the evolution of personality structure and health related quality of life.

Therefore, we can settle that the recognition of two forms of the same syndrome could provide a different interpretation of long-term prognosis. A-CSWSS group features allow a better prognosis than T-CSWSS group ones in terms of psychological adjustment, and social adaptation. So, in addition to clinical diagnosis and medical treatment, it would be desirable to provide early and longitudinal psychological support to all the patients with CSWSS (both typical and atypical) and psychoeducational training to the whole family.

Further studies in largest adulthood populations, previously affected by CSWSS, would increase our understanding of the QoL and personality profile of these subjects and provide suggestions for treatment planning and development of psychological interventions, such as psychotherapy, family counseling, education support or other specific rehabilitation interventions. Psychologists’ continued participation in the interdisciplinary care would improve the treatment, and the prevention of the psychopathological disorders in the epilepsy patients.

8. Potential conflict of interest interests

The authors declare any conflict of interests.

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