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BRIEF REPORT

Electroconvulsive therapy in adolescents with intellectual disability and severe self-injurious behavior and aggression: a retrospective study

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Abstract Efficacious intervention for severe, treatment-refractory self-injurious behavior and aggression (SIB/AGG) in children and adolescents with intellectual disability and concomitant psychiatric disorders remains a complex and urgent issue. The aim of this study is to assess the efficacy of electroconvulsive therapy (ECT) on severe and treatment-resistant SIB/AGG in young people with intellectual disability and current psychiatric disorder. We reviewed the charts of all patients ($N = 4$) who received ECT in the context of SIB/AGG with resistance to behavioral interventions, milieu therapy and pharmacotherapy from 2007 to 2011. We scored the daily rate of SIB/AGG per patient for each hospital day. Inter rater reliability was good (intraclass correlations = 0.91). We used a mixed generalized linear model to assess whether the following explanatory variables (time, ECT) influenced the course of SIB/AGG over time, the dependant variable. The sample included two girls and two boys. The mean age at admission was 13.8 years old [range 12–14]. The patients had on average 19 ECT sessions [range 16–26] and one patient received maintenance ECT. There was no effect of time before and after ECT start. ECT was associated with a significant decrease in SIB/AGG scores ($p < 0.001$): mean aggression score post-ECT was half the pre-ECT value. ECT appears beneficial in severe, treatment-resistant SHBA in adolescents with intellectual disability.

Keywords Electroconvulsive therapy · Self-injurious behavior · Aggression · Intellectual disability · Pervasive developmental disorder

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Introduction

Treatment of severe self-injurious behavior and aggression (SIB/AGG) in children and adolescents with intellectual disability is a complex issue. First-line interventions include tandem psychopharmacological and behavioral treatments, and are particularly effective when prominent operant functions are determined to maintain the challenging behaviors [1], and when underlying psychotropic-responsive psychiatric conditions are also evident. In some patients, SIB/AGG may persist despite exhaustive interdisciplinary interventions, exposing both patient and caregiver to significant injury risk, and sharply curbing psychosocial functioning. To date, only aripiprazole and risperidone have received FDA approval for use in children and adolescents for behavioral impairment associated with intellectual disability (ID) and/or pervasive developmental disorder (PDD), despite numerous adverse effects [2–4]. Recently, several cases of successful treatment by electroconvulsive therapy (ECT) in children and adolescents

with severe, intractable SIB/AGG associated with ID and psychiatric disorders have been reported [5–8].

The use of ECT in adolescents was first reported in the 1940s by Heuyer [9] in France and by L. Bender in the United States. Its frequency in pediatric patients in the late 1990s was estimated to range between 0.5 and 1 adolescent per million yearly [10], with multiple case reports documenting its efficacy in pediatric affective, psychotic and catatonic disturbance. Despite low usage rates, some authors have raised ethical concerns and alleged unknown secondary cognitive effects in an attempt to ban ECT use in adolescents [11]. This negative perspective regarding ECT in this age group is also codified in the laws of several states in the US [12]. The use of ECT in minors has been prohibited by legislation in California even in the case of life-threatening emergencies such as neuroleptic malignant syndrome (1974; for minors under age 12), Tennessee (1976; under age 14), Colorado (1977; under age 15) and Texas (1993; under age 16). The state of New York has recently implemented stringent regulations including professional agreement among three consultant child psychiatrists and approval of a hospital ethics board before ECT is administered to patient under age 16 [13]. Currently, a proposed ban on ECT in youth is being actively debated in the context of the new Mental Health Care Act of India 2010 with the erroneous claim that there are no indications for ECT usage in youth [14]. Nonetheless, both the American Psychiatric Association (APA) and the American Academy of Child and Adolescent Psychiatry (AACAP) do not consider age as a contraindication to ECT for specific indications of affective, psychotic and catatonic disorders [15, 16]. Recently, the AACAP issued "best practice" treatment parameters for ECT in adolescence [16]. In France, the use of ECT in teenagers is not prohibited, and guidelines are very similar to those formulated by the APA [17]. The indications in adolescents are the same as in adults. An opinion from an independent psychiatrist (outside the department) can be requested, but is not mandatory. Unfortunately, children and adolescents may be at risk to not receive appropriate treatment with ECT due to unrealistic fears and dogmatic views [10]; this problem is further compounded in youth with intellectual disability [18].

Despite controversy surrounding pediatric ECT, there is growing interest in such for treatment-refractory psychiatric conditions. Caution is recommended in patient selection, but efficacy is observable in the treatment of severe and treatment-resistant mood disorders and catatonic syndromes [10, 19]. The number of studies of ECT during adolescence is low with only three controlled trials [20–22]. As reported in a review [19], recent studies demonstrated concordance with the results obtained in earlier review [23]. Namely, a marked improvement was seen in 69 % of patients with a major depressive episode without psychotic features and in 85 % of those with psychotic features. In patients with catatonia, 13 of 15 patients (86 %) treated with ECT saw their condition improve.

Case reports of ECT in adults with ID and psychiatric disorders (mood disorders and psychotic disorders) are reported [24–26]. Reinblatt et al. demonstrated efficacy and safety of ECT in intellectually disabled patients who presented mood disorders [25, 27, 28]. Few case reports of young people with ID and psychiatric disorders treated by ECT are reported [29]. There currently exist only nine case reports of children and adolescents, presenting with PDD and/or ID and severe and resistant SIB/AGG successfully treated by ECT [29–32], which are summarized in Table 1.

Given the paucity of data, the aim of this study was to assess the efficacy of ECT in youth with longstanding, severe and treatment-resistant SIB/AGG in the context of ID and underlying psychiatric disorder (mood disorders or schizophrenia) using a statistical method (generalized linear mixed model) developed to measure treatment effect in patients who remain resistant to multiple-treatment approaches. This method was previously successfully applied to assess clozapine [33], intensive behavioral approaches [34] and wet sheet packing [35] in the same context. We retrospectively reviewed all inpatients who received ECT over a 5-year period (2007–2011). Among them, four presented severe SIB/AGG in the context of intellectual disability and concomitant psychiatric disorder.

Methods

Participants

We reviewed data from all cases of child and adolescent inpatients who received ECT during their inpatient stay from 2007 to 2011. We found 11 cases; among them, seven had an intellectual disability and we selected those who also had frequent, severe and treatment-resistant SIB/AGG. There were two girls and two boys, aged 12–14 years old. There was no exclusion criterion. The four patients were hospitalized in the Department of Child and Adolescent Psychiatry at a university teaching hospital (GH Pitié-Salpêtrière, Paris) between 2007 and 2011. At this department, ECT is proposed as an alternative treatment for patients who present severe and resistant psychiatric disorders such as catatonia, severe mood disorders or schizophrenia. It is the only child and adolescent department in Paris where ECT is available.

Procedure and variables

We retrospectively reviewed charts from the hospitalization period for the four patients, including clinician and

Table 1 Case reports of electroconvulsive therapy in children and adolescents with severe self-injurious behavior/aggression, intellectual disability and acute psychiatric disorder

Study	Sex, age	Developmental history	Current psychiatric diagnosis	Presence of self-injurious behavior and aggression (SIB/AGG)	Previous treatments	ECT nb sessions	Efficacy
Thuppal [30]	M, 18	ID	TB I (manic episode)	SIB/AGG	Thioridazine, carbamazepine, valproate, risperidone, clozapine	17 + maintenance	Clinical improvement
Fink [31]	M, 14	ID		SIB/AGG	Several psychotropics	16	Clinical improvement
Friedlander [32]	M, 17	ID	Schizo-affective disorder, depressive subtype, catatonia	SIB (banging his head against wall) and AGG	Chlorpromazine, paroxetine, lithium, lorazepam	15	No improvement
Wachtel et al. [5]	F, 18	Autistic syndrome, Tourette's syndrome, ID	Catatonia (gastric tube for nutrition)	Self-injurious behavior with major impact (bilateral traumatic cataracts) with need surgery	Lorazepam, citalopram, behavioral interventions	12 (first course) + 13 (second course) + maintenance	Catatonic stupor resolved, marked reduction of self-injury
Wachtel et al. [6]	M, 8	Autistic syndrome, ID	Mood lability	Extreme self-injurious behavior towards his head: 109 self-injurious attempts per hour (lasting 5 years)/use protective equipment	Several psychotropics, behavioral interventions	15 + maintenance	Reduction of self-injurious attempts from 109 to 19 hourly, mood stabilization, return to educational and social activities
Wachtel et al. [7]	M, 14	Autistic syndrome, ID	Malignant catatonia (bradycardia and hypothermia)	Severe self injury	Lorazepam, IV therapy (rehydratation) and nasogastric feed	10 (unilateral) + 3 times/week (bilateral) + maintenance (6 months)	Resolution of malignant catatonia, clinical improvement, weight gain (combination ECT + lorazepam). Return to educational and social activities
Wachtel et al. [7]	M, 15	ID, cerebellar dysgenesis (cerebral vascular accident in utero)	Malignant catatonia	Repetitive self-injurious and aggressive behaviors	Risperidone, lorazepam, lithium, paroxetine	8 + maintenance	Resolution of malignant catatonia. Return to home and school
Wachtel et al. [7]	M, 19	Autistic syndrome, ID	MDE, catatonia	Several suicide attempts, life-threatening repetitive self-injurious behaviors, aggressive behaviors	Lorazepam, chlorpromazine, risperidone, aripiprazole, quetiapine, olanzapine, ziprasidone, haloperidol, mood stabilizers, antidepressants, behavioral interventions	7 + maintenance	Resolution of catatonia, excellent remission of symptoms
Wachtel et al. [8, 50]	M, 11	Autistic syndrome, ID	Bipolar disorder	Severe and dangerous episodes of self injury and aggression (lasting 4 years)	Psychotropic resistant BD, behavioral interventions	8 + maintenance	Mood stabilization, improvement of self-injurious and aggression (ABC), possible to go back to school

MDE major depressive episode, *ECT* electroconvulsive therapy, *ID* intellectual disability, *ECT* electroconvulsive therapy, *BD* bipolar disorder, *ABC* aberrant behavior checklist

nurse notes. Selected data included socio-demographic data, medical histories, psychiatric diagnosis and treatment information. Socio-demographic data were systematically assessed at admission and included age, gender, and psychosocial history. A detailed medical history based on personal family and past psychiatric history was recorded at intake using a semi-structured interview [36]. The inpatient team used standardized instruments to improve diagnosis (e.g. Autism Diagnostic Interview-Revised when PDD was suspected; Diagnostic Interview for Genetic Study when schizophrenia or a mood disorder was suspected) based on DSM-IV criteria. However, here diagnoses were also made through the team consensus best-estimate diagnostic method due to the difficulties involved in testing individuals who exhibit such problematic behaviors and/or psychosocial backgrounds [37]. ID was determined either via functional diagnosis or IQ < 70. Three had mild and one had moderate intellectual disability. Catatonia was diagnosed using the Bush and Francis modified version scale [38–40]. The diagnostic team included resident and senior psychiatrists with extensive inpatient care experience (DC, VG and AC).

To assess the effect of ECT on SIB/AGG, medical and nurse files were systematically reviewed [33, 34]. Following the Lambrey et al. method, each day was coded for aggression as follows: a score was given for each nursing shift (i.e., morning, afternoon and night) on each day; 0 indicated no aggressive behavior, 1 indicated at least one unquestionable physically aggressive act (e.g., destroying property, assaulting others, self-harm). By summing the three periods per day, scores were computed ranging from 0 to 3 per day of inpatient stay for each patient, and from 0 to 21 for 7 consecutive days. In a previous study, inter rater reliability regarding daily aggression score was calculated on 71 randomly selected patient days [33]. The intraclass correlation (ICC) between two blind raters was excellent (ICC $= 0.91$) [33].

Statistical analysis

Statistical analysis was performed using the software R version 2.12.2, with a risk of type I error of 5 %. The dependent variable, the weekly score of self-injurious or aggressive behavior (obtained by summing each daily score within the same week) followed a Poisson distribution. Subject was included as a random effect to control for potential within-subject correlation. Finally, a generalized linear-mixed model with Poisson distribution was chosen to explain the severity score of SIB/AGG based on the number of weeks of hospitalization (continuous) and the presence or absence of ECT (binary variable). The "glmer" function of the "lme4" package was adopted, using the restricted maximum likelihood (REML) method.

Results

Table 2 summarizes the socio-demographic and clinical characteristics of the patients. The sample included two girls and two boys. The mean age at admission was 13.8 years old [range 12–14]. The mean duration of stay was 274.75 days. The four patients presented with severe SIB/AGG comorbid with intellectual disability. Two also had a history of PDD. Two patients had a known genetic abnormality. Cognitive assessment was available from previous assessments for two patients. For the two others patients, assessments were impossible during hospitalization, given the severity of the behavioral symptoms but intellectual disability was confirmed by available clinical data and/or previous school assessments. Acute psychiatric diagnoses according to DSM IV criteria included mood disorders (manic, mixed and major depressive episode) and schizophrenia.

The patients had on average 19 ECT sessions [range 16–26] and one patient had maintenance ECT. Anesthesia for ECT was induced using intravenous propofol (10–170 mg, mean $= 71.51$ mg) and/or etomidate (2–12 mg, mean $= 1.18$ mg). Muscle relaxation was achieved with intravenous suxamethonium (25–70 mg, mean $= 44.27$ mg). ECT was given using a Thymatron-IV device that produces a brief pulse electric current (pulse width 1.0 ms, pulse duration 3.2 s) with a 30–70 Hz frequency. The electrical stimulus was applied using the standard bilateral electrode position with 10–30 % energy (0.75–0.92 A). Clinicians reported no significant adverse events.

Figure 1 summarized the generalized linear-mixed model for all patients combined. Time 0 is defined for each patient as first ECT session. There was no effect of time before and after the ECT was started. The slope of the regression line for the aggression scores per week was null before the onset of ECT ($\alpha = -0.01297$, $p = 0.21$). The mean value per week remains stable equal to 4 ($y = 4$). Similarly, after the beginning of ECT, slope of the right of regression for the aggression scores per week was null ($\alpha = 0.01781$, $p = 0.15$). The mean value per week remains stable close to 2 ($y = 1.8$). ECT was associated with a significant decrease in SIB/AGG scores ($p < 0.001$): mean aggression score post-ECT was halved as compared to pre-ECT values.

Discussion

To our knowledge, this is the first study evaluating the efficacy of ECT for treating severe SIB/AGG in children and adolescents hospitalized for such behaviors and refractory to first-line behavioral, psychotropic and

Table 2 Socio-demographic and clinical characteristics of adolescents ($N = 4$) with severe self-injurious behavior/aggression and ID who received ECT during hospitalization

Case	Sex, age	Duration in days[a]	Developmental diagnosis	Acute diagnosis (DSM IV)	Organic diagnosis	Cognitive assessment	Self-injurious behavior/ aggression (SIB/AGG)	Past medications and current medications	Aggression score		ECT (No. of sessions)	Clinical improvement
									Pre-ECT	Post-ECT		
1	M, 14	228	ID	Catatonic Schizophrenia	ProDH mutation	Not possible	SIB: 7 severe attempts of hanging in few days AGG: he threatened his brother with a knife, violence against nurses as punching, kicking Hospitalized for more than 2 years in a local child psychiatric department before transfer in intensive care unit	*Risperidone*, *zuclopenthixol*, *chlorpromazine*, *valproic acid*, *clonazepam*, *lorazepam*, amisulpride	3 ± 2	1.04 ± 0.8	12	Decreasing of AGG. No more SIB. Possible hospital discharge and investment in host family with daily psychiatric care
2	F, 12	111	ID	Mixed episode with excited catatonia	None	Not possible	SIB: bangs head against walls, hand-head, suicide attempts (defenestration) AGG: punching, kicking, slapping against family members and nurses Hospitalized for 2 years in a local child psychiatric department before transfer in intensive care unit	Risperidone, *propericiazine*, *haloperidol*, *cyamemazine*, *olanzapine*, *clonazepam*, *aripiprazole*, *valproic acid*, lorazepam, chlorpromazine	5.25 ± 2.3	2.43 ± 1.8	16 + maintenance ECT	Decreasing AGG and SIB. Discharge from intensive care unit and go back home with daily care
3	F, 14	382	ID, PDD-NOS	Major depressive episode (BD-III)	Deletion 13q34	WISC-IV: VC = 45; PR = 45; WM = 70; PS = 50; TIQ = 42	SIB: bangs head against walls, try to extract her eye with a fork, severe and repeated self-strangulations leading to loss of consciousness and seizure AGG: scratches, bites	*Risperidone*, *cyamemazine*, *aripiprazole*, *haloperidol*, *valproic acid*, *topiramate*, *sertraline*, *mirtazapine*, carbamazepine (interruption during ECT)	5.54 ± 3.2	2.72 ± 1.7	22	Decreasing AGG. No more SIB. Discharge from intensive care unit and go back home with daily care.
4	M, 13	378	ID, PDD-NOS	Manic episode	None	WISC-III: VIQ = 73; PIQ = 62; TIQ = 64	SIB: hits his head, daily ingestion of objects, scars, frequent running away AGG: nurses and parents' aggressions (punching, kicking)	*Risperidone*, *vaproic acid*, *lithium* (*interruption during ECT*), chlorpromazine	3.19 ± 3	1.5 ± 1.6	26	Decreasing SIB and AGG. Discharge from intensive care unit, transfer in a local child department psychiatry

Past medications in italic and current medications in normal

F female, *M* male, *PDD-NOS* pervasive developmental disorder-not otherwise specified, *ID* intellectual deficiency, *BD-III* bipolar disorder subtype III, *V or P or TI* verbal or performance or total intellectual quotient, *VC* verbal comprehension, *PR* perceptual reasoning, *WM* working memory, *PS* processing speed, *Bl* bilateral, *SHB* self harming behavior, *A* aggression

[a] Duration of hospitalization included also days spent outside the hospital (e.g. week end)

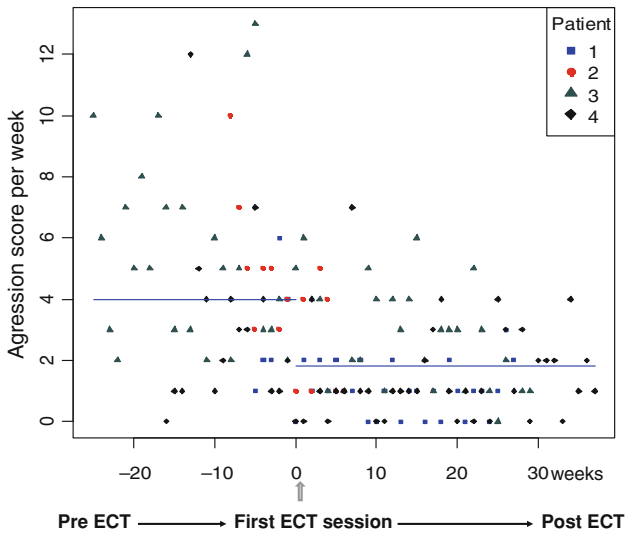

Fig. 1 Effect of ECT on aggression score in children and adolescents with intellectual disability and severe self-injurious behavior/aggression

combined interventions (medication and behavioral approaches). Even after adjustments for time, ECT appeared to significantly decrease SIB/AGG. To date, evidence-based psychotropic treatment recommendations are limited to antipsychotics, although there are multiple case reports documenting efficacy of additional agents, such as naltrexone and SSRIs in select cases. The efficacy of atypical antipsychotics for SIB/AGG and/or irritability in children and adolescents with PDD and/or ID has been demonstrated in several randomized placebo-controlled trials. To date, risperidone [41–45], aripiprazole [46, 47] and divalproex [48] have been shown to be superior to placebo in reducing irritability and/or aggression. In some treatment-resistant cases with autism, clozapine [33] or intensive behavioral intervention [34] appeared to be efficient in relieving SIB/AGG using the same generalized linear mixed model method. However, these studies were exploratory given the lack of randomization and control group. The current study together with the nine case reports published so far (Table 1) support the use of ECT for the same indication.

Decreasing SIB/AGG with ECT is directly connected with the efficacy of ECT on the underlying psychiatric condition (mood disorders, catatonia and schizophrenia). In this sample, two inpatients presented with a catatonic syndrome (catatonic schizophrenia and excited catatonia). The efficacy of ECT in catatonia in general has been documented for decades [31, 49], and comparable efficacy of ECT for catatonia in intellectual disabilities has been demonstrated in a growing number of case reports [19, 50]. However, catatonia is not always well recognized, particularly in patients with ID and/or PDD [51, 52]. Additionally and as previously described, self injury in patients with PDD can represent an alternate symptom of catatonia [53]. This hypothesis considers self-injury as a type of stereotypy, a classic symptom of catatonia, and asserts the further connection between stereotypy, tics, self-injury and catatonia, as well as presenting historical and modern reports of self-injury in documented catatonia. Central gamma-aminobutyric acid (GABA) dysfunction may provide an important role regarding this association [53]. Recently, cases of young people with Down syndrome and catatonia have been reported [54]. The authors underline the importance of considering catatonia in any patient with Down syndrome when motor symptoms are present. More generally, catatonia should be recognized in patients with ID and motor symptoms.

Three patients were further diagnosed with mood disorders in our sample. Two of them did not present with catatonic syndrome yet their symptoms improved as well. Previous reports underline the efficacy of ECT in adults with ID and mood disorders [25, 28]. It is crucial to increase knowledge and research about ECT-responsive conditions in ID. Indeed, concerning patients with ID as the diagnostic approach is often complicated by the phenomenon of diagnostic overshadowing, where readily diagnosable and treatable psychopathology is simply dismissed as part and parcel of the underlying disability [55–57]. Psychiatrists may further be reluctant to treat such patients with ECT given the diagnostic difficulties and the paucity of data in this domain and particularly in young people.

Finally, patients clinically improved and three among them were able to return to a less restrictive environment (daily care instead of full time hospitalization). It is important to note that the hospitalizations were particularly prolonged (mean duration was 275 days), which implies financial repercussions that our care system allows as necessary.

Several limitations of this study should be mentioned: (1) the retrospective collection of the data; (2) the small sample size; (3) the fact that the evaluation of the severity was not conducted by researchers blind to the diagnosis; (4) the absence of an a priori definition of responders, given the retrospective design; (5) the lack of a control group. However, strengths should be noted as well, including excellent intraclass correlation of the aggression score as well as each patient serving as his own control without any patient exclusion. Then, given that the time effect was being accounted for using the GLM model, the absence of improvement with time confirmed the resistance to medication, behavioral interventions and milieu therapy. Given the difficulty of including such severely afflicted patients in double-blind placebo-controlled trials, the current method may be an alternative to assess treatment efficacy [33–35]. However, multisite trials with prospective design and blind

assessment would ideally be pursued to limit methodological biases.

We concluded that despite the exploratory nature of this study, the results suggest that ECT is a valuable treatment option for severe and treatment-refractory self-injurious behavior and aggression in children and adolescents with PDD and or ID.

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