The Effect of Family Training on Salivary Cortisol in Children with Disruptive Behavior Disorder

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Objective: Antisocial, aggressive and delinquent behaviors in adults often begin early in life. Basal cortisol is a valuable biological marker in children with disruptive behavior disorder (DBD). To investigate the association between biological factor (cortisol) and disruptive behaviors, we studied the effect of family training on salivary cortisol level in children with DBD.

Methods: Basal salivary cortisol levels were studied in 19 children with DBD, (aged 8 -13 years old) prior and 2 months after the treatment. The disruptive behavior of the child was also assessed by **C**hild Behavior Checklist (CBCL), before and 2 month**s** after treatment.

Results: Children with lower basal cortisol level had more sever behavioral problems. Surprisingly, this group had a better response to family therapy.

Conclusion: Parental training is an effective method for behavioral modification of children with DBD. Salivary cortisol can be considered as a biological marker for the severity of disruptive behavior and response to therapy.

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Introduction

Oppositional and antisocial behaviors are the most frequent reasons for referral of children and adolescents to mental health services, accounting for about one- third to one- half of all cases**.** Thus, it is not altogether surprising that some researchers prefer to use a separate diagnostic category, the Disruptive Behavior Disorder (DBD) (1-3) which includes Conduct Disorder (CD) and Oppositional Defiant Disorder (ODB) (4).

Children with DBD are at high risk of criminality and antisocial personality disorder in adulthood (5). DBD can be a cause of serious difficulties in school life as well as in peer relationship (1,2). However, convincing evidence of causal linkage between multiple domains of this disorder remains elusive. Research has questioned the notion that these disorders are intractable, especially when multiple domains of risk and impairment are the targets of intervention (6).

It is therefore important to investigate the associations between biological factors and disruptive behaviors in children and adolescents, because antisocial, aggressive and criminal behaviors often have their onset early in life (7,8). There is fairly convincing evidence that children with antisocial traits have reduced skin conductance levels and heart rate, which both have a predictive relationship with later antisocial behavior (3). These disorders are often thought to be associated with low activity of Hypothalamic-Pituitary- Adrenal axis (HPA) (7,9-11).

In recent years, two influential theories have postulated that there is an association between disruptive behavior and low arousal (10). According to the first, the fearless theory, a low tendency to become aroused in reaction to fearful stimuli would result in a higher likelihood to become disruptive (12). Hence, based on the fearless theory, an association between high disruptive behavior levels and

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low HPA- axis activity could be expected (9). The second theory is the sensation-seeking theory. It postulates that low arousal is an unpleasant physiological state (12). To get rid of this state, individuals with low arousal would seek stimulation, for instance they might initiate antisocial behaviors that increase physical tension (12,7).

One of the most provocative neuroendocrinologic finding reported in ODD and CD is abnormal basal cortisol concentration which is the end product of HPA axis (3,11,13-15).

Several studies have shown that there is an inverse relationship between the level of cortisol and disruptive behavior (3,11,13,14,16,17). Other studies have found no relationship (18,19). However, it seems that both basal level of cortisol and stress-related cortisol level could be a valuable biological marker of individuals with DBD. Only a small number of studies have been conducted to address the issue of predictive value of basal cortisol levels for later aggressive behavior (11).

One area that has received little attention is the study of the relationship between cortisol and outcome of psychotherapeutic interventions. As psychotherapy and family training are the major treatment strategies in the management of DBD(1,2)**,** we investigated the relationship between basal salivary cortisol and severity of symptoms before and after family training in children with DBD.

Furthermore, we studied the therapeutic effects of family training on behavioral modification and severity of symptom in DBD.

Materials and Methods

Study was undertaken in a child and adolescent psychiatric clinic in Isfahan from 2006 to 2007. DBD was diagnosed by a child psychiatrist.

From outpatient referrals, 19 children and adolescents (16 boys and 3 girls, aged 8-13 years old), who gave consent to take part in the study and met the criteria of the Diagnostic and Statistical Manual of mental disorder, Forth edition text revision (DSM-IV-TR) (4) for DBD were selected.

Inclusion criteria were an age between 8-13 years, no history of psychiatric drug use, IQ above 80 according to Wechsler IQ test (WISC-R) (20), no physical illness and a Child Behavioral Check list (CBCL) of above 95 percentile. CBCL has a high constant validity and a reliability of more than 90% (21,23). CBCL (parents report) was completed before and 2 months after treatment.

Saliva was collected from all participants at 7-8 am (16,24-27) before and 2 months after treatment. Salivary cortisol is a valuable indicator of baseline free plasma cortisol level (collected not under any stress or post injection) (16,24,28). Saliva production was stimulated with citric acid and samples were kept in plastic vials and stored at -20 **º**C. Saliva cortisol concentration **was** measured without extraction using an in-house competitive ra**t**io immunoassay with a polycolonal anticortisol antibody (K7348). [1,2- ^{3} H (N)]. Chromatographic verification of purity of salivary cortisol was conducted in Noor center laboratory**,** in Isfahan, Iran**.** Hydrocotisone (NET 185, NEN- Dupont, Dreich, Germany) was used as a tracer. The lower limit of detection was 0.5 n mol/l and interassay variation was 11.0 %, 8.2 %, and 7.6 % at 4.7 nmol/l, 9.7 nmol/l, and 14.0 n mol/l respectively (n=10).

All parents of the children who participated in the study took part in an 8 weeks family training program , according to triple P method (29) (table 1).

In these sessions, a child and adolescent psychiatrist provided training on behavioral modification and management.

Table 1. Time table for training parents: Triple P method

Session	Time (hour)	Content
1st week	2	Positive parenting
2nd week	2	Promoting children development
3rd week	2	Managing challenging behavior
4th week	2	Planning ahead
5th week	2	Implementing parenting routine I
6th week	2	Implementing parenting routine II
7th week	2	Implementing parenting routine III
8th week	2	Program close

Statistical Analysis

Data were analysed by SPSS. Paired t- test

was used to compare the mean cortisol level and CBCL score before and after intervention. Correlation between cortisol level and CBCL score was also studied (significant p value < 0.05).

Results

Out of 19 subjects with DBD, 16 (84.2 %) were boys and 3 (15.8 %) girls. 16 children had a diagnosis of ODD and 3 CD. Co morbidity with Attention Deficit Hyperactivity Disorder (ADHD) was diagnosed in 15 children.

The mean of salivary cortisol level before parental training was 7.9 ± 4.6 n mol/l. It was 10.48 ± 3.84 n mol/l after treatment. This difference was statistically significant ($p < 0.001$, $t = -4.213$, $dF = 18$). Paired t test also showed a statistically significant difference in CBCL score before and after parental training ($T = 9.385$, $df = 18$, $p < 0.0001$) (Table 3).

Our study also showed that there was a correlation between high score in CBCL and a low cortisol level. Furthermore, there was **a** correlation between low cortisol level before treatment and a good response to parental training (Table 4).

Table 2. Age groups of subjects

Age groups (year)	Frequency (N)	Prevalence (%)
8- 9	6	31.6
10- 11	8	42.1
12- 13	5	26.3
Total	19	100

Table 3. CBCL score before and after treatment

CBCL	Mean score	Standard Deviation	Number
Before treatment	72.05	10.11	19
After treatment	49.36	11.18	19

Table 4. Pearson correlation between CBCL mean score and salivary cortisol measure.

		CBCL before treatment	CBCL after treatment
Cortisol before treatment	Pearson correlation	0.511	-0.358
	P Value	0.025	0.132
Cortisol after treatment	Pearson correlation	0.546	-0.481
	P Value	0.016	0.037

Discussion

The aim of this study was to evaluate the predictive value of cortisol as a biological marker for disruptive behaviors in children and response of parents to family training. The results of our study show that children with DBD and lower basal salivary cortisol level have more severe disruptive behavior. Also, it shows that there is a relationship between the lower salivary cortisol levels and the better response to parental training.

Parental training is an acceptable and effective psychotherapy for behavioral modification in children with DBD. Findings of our study are in agreement with the results of previous research projects that found a reversed correlation between level of cortisol and impulsivity, substance abuse and violence (30,31). Although there have been several studies (7,18,27), which could not find any correlation between the level of cortisol and severity of disruptive behavior in children, there are so many others confirming such an association.

Mc Burent K and his colleagues demonstrated a relationship between low basal salivary cortisol and aggression in boys with DBD (11). Pajer K et al. have also shown that there is an association between reduced cortisol level and antisocial behavior in adolescent with conduct disorder (13). There is also evidence for an association between reduced salivary cortisol level in children with disturbed behavior in children with a diagnosis of combined Attention Deficit Disorder and Oppositional Defiant Disorder (14). Vanyker et al. also found a negative correlation between antisocial symptoms and cortisol level in pre-adolescent boys (17). Shoul et al. conducted a 5 years longitudinal study on adolescent boys. They concluded that lower salivary cortisol level was associated with aggressive behavior (32).

Similar to what we have proposed, McBurent et al. have also suggested that cortisol level has a predictive value regarding the severity of aggressive behavior (11).

One of the limitations of our study was that, there was not a control group for comparison of the data. The study sample size (n=19) was also small.

Conclusion

Salivary cortisol can be considered as an indicator of the severity of disruptive behavior in children with DBD. Our study also revealed that there is a significant association between the salivary level of cortisol and treatment response to parental training.

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