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Authors running head: Y. Harada *et al.*

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*Correspondence: Yuzuru Harada, MD, PhD, Mental Health Clinic for Children, Shinshu University Hospital, 3-1-1 Asahi, Matsumoto, Nagano 390-8621, Japan. Email: y_harada@shinshu-u.ac.jp

Regular Article

Impact of behavioral/developmental disorders comorbid with conduct disorder

Yuzuru Harada, MD, PhD,¹ Ayako Hayashida, MD,¹ Shouko Hikita, MA,¹ Junko Imai, MD,¹ Daimei Sasayama, MD,² Sari Masutani, MD,¹ Taku Tomita, MD, PhD,³ Kazuhiko Saitoh MD, PhD,⁴ Shinsuke Washizuka, MD, PhD² and Naoji Amano, MD, PhD²

¹Shinshu University Hospital, Mental Health Clinic for Children, •••, ²Shinshu University School of Medicine, Psychiatry, •••, ³National Musashino Gakuin, ••• and ⁴International Medical Center of Japan, Kounodai Hospital, ••• Japan

Aims: The aim of the present study was to verify the comorbidity of conduct disorder (CD) and behavioral/developmental disorders in children and adolescents, and to examine the treats of CD comorbid with them.

Methods: Subjects were 64 children (60 boys, four girls) who were resident at three institutions for delinquent children or who were conduct-disordered outpatients of a university hospital aged under 18 years. A diagnostic interview was carried out by experienced child psychiatrists and the intelligence score and the Adverse Childhood Experiences score were measured by a licensed psychologist.

Results: A total of 57 children were diagnosed as having CD, of whom 26 (45.6%) were diagnosed with comorbid attention-deficit-hyperactivity disorder (ADHD), 12 were diagnosed with comorbid pervasive developmental disorder (PDD, 21.1%), and 19 (33.3%) had no comorbidity of either disorder. Six children (18.8% of CD comorbid with ADHD) met the criteria for both ADHD and PDD. The group with comorbid PDD was significantly younger at onset ($F = 6.51$, $P = 0.003$) and included unsocialized type more frequently ($\chi^2 = 6.66$, $P = 0.036$) compared with the other two groups.

Conclusions: Clinicians should be aware that not only ADHD but also PDD may be comorbid with CD. Establishment of the correct diagnosis is important because recognizing the presence of PDD will enable us to provide appropriate treatment and guidance, which may improve prognosis.

Key words: attention-deficit-hyperactivity disorder, conduct disorder, oppositional defiant disorder, pervasive developmental disorder.

Since the inclusion of conduct disorder (CD) in the third edition of the DSM, a close association has been suggested between CD and attention-deficit-hyperactivity disorder (ADHD). Holmes *et al.*, in their review of risk factors in childhood that lead to CD and antisocial personality disorder (APD), held that impulse control dysfunction and the presence of hyperactivity and inattention are the most highly related predisposing factors for the presentation of antisocial behavior.¹ They asserted that ADHD could contribute greatly to problematic behavior and antisocial acts, and the hyperactivity component of ADHD was very important to the development of later CD and APD.

The association between pervasive developmental disorder (PDD) and CD or delinquency, in contrast, has received surprisingly little attention. Such comorbidity has generally been considered to constitute a very small proportion of the cases of CD. Siponmaa *et al.*, however, reported that 15% of 126 young offenders (15–22 years) had a definite diagnosis of ADHD, and another 15% had PDD, including 12% with PDD not otherwise specified (PDD-NOS) and 3% with Asperger's syndrome, and that the rate of PDD found was particularly striking.²

The primary objective of the present study, therefore, was to answer the question of whether it is sufficient to

consider ADHD as the unique behavioral/developmental disorder comorbid with CD. Our preliminary assumption was that the comorbidity of PDD with CD is more common than has been previously considered, so we carried out a diagnostic interview to assess the comorbidity of behavioral/developmental disorder with CD.

If our assumption that the comorbidity of PDD with CD is more common than previously thought is true, a possible explanation for the lack of attention to comorbidity of PDD may be that a substantial number of children with PDD are misdiagnosed as having ADHD due to the overlapping hyperactivity and inattention symptoms. Therefore, to confirm this assumption, the second aim of the present study was to investigate the overlapping conditions between PDD and ADHD comorbid with CD.

We also examined the differences in traits of CD depending on the type of comorbid behavioral/developmental disorder. This was the third aim of the present study.

METHODS

Subjects

In order to reduce the bias caused by selecting subjects from a specific institution, subjects were selected from three settings: two correctional institutions for delinquent children aged under 15 years (facilities A and B), an institution for male juvenile offenders aged between 15 and 18 years (facility C), and a university hospital outpatient department for children under 18 years (hospital D).

During the period April 2005–October 2006, all institutionalized children in facilities A and B, newly institutionalized children in facility C, and all outpatients who visited hospital D with conduct problems were selected as subjects. Those from facility C were limited only to newly institutionalized children because parental informed consent could not be obtained for already institutionalized children. Eighty children (74 boys, six girls) were recruited originally: 29 children (26 boys, three girls) institutionalized in facilities A and B, 40 boys newly institutionalized in facility C, and 11 children (eight boys, three girls) who visited hospital D.

After receiving written informed consent from the legal guardian of each child, or from the staff of the institutions responsible for the children when their guardians could not be contacted, the sample group consisted of 64 children (60 boys, four girls).

A total of 57 of the 64 children (54 boys, three girls; 89.1% of the participants, mean age 15.5 ± 1.7 years) were diagnosed with CD by means of the interview based on DSM-IV: 25 children from facilities A and B (23 boys, two girls; 86.2% of the institutionalized children; mean age 14.3 ± 1.1 years), 25 boys from facility C (62.5% of the newly institutionalized children; mean age 16.8 ± 1.2 years), and seven children who visited hospital D (six boys, one girl; 63.6% of children who visited with conduct problems; mean age 15.0 ± 1.7 years).

All personal data were made anonymous and were handled confidentially. Statistical analysis was conducted by a full-time statistician. The study protocol was approved by the ethics committee of Shinshu University.

Procedures

Experienced child psychiatrists diagnosed developmental and behavioral disorders and their subtypes including ADHD, oppositional defiant disorder (ODD), CD and PDD conforming to DSM-IV. They also collected information that included the onset age and socialized or unsocialized type of CD defined by DSM-III.

The Japanese Wechsler Intelligence Scale for Children–Third Edition (for children between the ages of 6 and 15 years)³ or the Japanese Wechsler Adult Intelligence Scale–Revised (for children between the ages of 16 and 18 years)⁴ was administered and the Adverse Childhood Experiences score (ACE score) determined by a licensed psychologist.

The ACE score, produced by the ACE study led by Felitti *et al.* is perhaps the largest scientific research study of its kind, analyzing the relationship between multiple categories of childhood trauma and health and behavioral outcomes later in life.⁵ ACE includes the following experiences in the household prior to age 18 years: recurrent physical abuse, recurrent emotional abuse, contact sexual abuse, an alcohol and/or drug abuser in the household, an incarcerated household member, someone who is chronically depressed, mentally ill, institutionalized, or suicidal, mother treated violently, one or no parents, and emotional or physical neglect. Exposure to one category (not one incident) of ACE qualifies as 1 point. The points are summed to obtain the ACE score.

Categorization

Subjects were divided into three groups according to type of comorbid behavioral/developmental disorder: comorbidity with ADHD (ADHD group), comorbidity with PDD (PDD group), and non-comorbidity with ADHD or PDD (NC group). Age at onset, type of CD (whether socialized or unsocialized), comorbidity with ODD, number of corresponding items for the diagnostic criteria for CD (CD criteria), full-scale IQ (FIQ) and the ACE score were compared between the groups.

Although CD is used as an exclusion criterion for ODD in DSM-IV, this was neglected, allowing dual

diagnosis for the purpose of fully understanding the characteristics of the subjects. The exclusion criteria preferring PDD over ADHD was also not applied when examining the overlap of ADHD and PDD.

Statistical analysis

The χ^2 test was used for categorical data. For continuous data a *t*-test for two groups and one-way analysis of variance (ANOVA) for three groups were used to test the hypothesis of equality of means. When a significant difference was detected between the three groups, Tamhane T2 post-hoc analysis was used for multiple comparisons. Two-tailed tests of significance were used and the level of significance was set at $P < 0.05$. All data were analyzed using SPSS 13 for Windows (SPSS, Chicago, IL, USA).

RESULTS

Table 1. Subject profiles

	Facilities A and B ($n = 25$) (Mean \pm SD)	Facility C ($n = 25$) (Mean \pm SD)	Hospital D ($n = 7$) (Mean \pm SD)
Boys : Girls, n	23:2	25:0	6:1
Age at the time of study (years)	14.3 \pm 1.1	16.8 \pm 1.2	15.0 \pm 1.7
Onset age (years)	10.0 \pm 2.7	13.7 \pm 1.9	11.6 \pm 2.9
Socialized type : Unsocialized type, n	14:11	20:5	3:4
Comorbid with ADHD, n (%)	8 (32.0)	13 (52.0)	5 (71.4)
Comorbid with PDD, n (%)	8 (32.0)	2 (8.0)	2 (28.6)
Comorbid with ODD, n (%)	9 (36.0)	11 (44.0)	4 (57.1)
FIQ	87.9 \pm 11.3	94.9 \pm 11.7	91.7 \pm 12.3
ACE score	2.0 \pm 2.1	1.1 \pm 1.4	1.5 \pm 1.5
CD criteria	6.6 \pm 2.8	5.2 \pm 1.7	9.1 \pm 4.1
Aggression to people and animals	2.3 \pm 1.8	1.6 \pm 1.2	2.3 \pm 2.1
Destruction of property	0.4 \pm 0.5	0.3 \pm 0.5	0.6 \pm 0.8
Deceitfulness or theft	2.0 \pm 0.9	1.3 \pm 0.8	3.0 \pm 1.6
Serious violations of rules	2.0 \pm 1.3	2.0 \pm 1.2	3.3 \pm 1.5

ACE, Adverse Childhood Experiences; ADHD, attention-deficit–hyperactivity disorder; CD criteria, no. corresponding items in the diagnostic criteria for conduct disorder; FIQ, full-scale IQ; ODD, oppositional defiant disorder; PDD, pervasive developmental disorder.

Table 1 lists the profiles of all 57 subjects. There were no significant differences between the three types of facilities with respect to gender ratio, age at onset, types of CD, types of comorbid behavioral/developmental disorders, FIQ and ACE scores. Although CD criteria for the subjects from hospital D were relatively high, we must consider the result to be preliminary because the number of subjects was so small.

On applying the exclusion criteria of DSM-IV preferring PDD over ADHD, 26 children (25 boys, one girl; 45.6% of the subjects; mean age 15.8 \pm 1.4 years) were included in the ADHD group, 12 children (11 boys, one girl; 21.1% of the subjects; mean age 14.0 \pm 1.8 years) were included in the PDD group, and 19 children (18 boys, one girl; 33.3% of the subjects; mean age 16.1 \pm 1.6 years) were included in the NC group. Only four children including three with ADHD and one with PDD were diagnosed prior to the study.

By neglecting the exclusion criteria of DSM preferring PDD over ADHD, six subjects satisfied the criteria for both ADHD and PDD, representing 18.8% of those who met the criteria for ADHD (32 out of 57 subjects) and 50% of those who met the criteria for PDD (12 of 57 subjects). Of the children diagnosed as having CD, seven (12.3%) had an IQ below 79 (one with mental retardation and six with borderline intellectual functioning). The overlap of behavioral/developmental disorder is shown in Fig. 1.

Table 2. Subject profiles vs comorbidity

	ADHD group (<i>n</i> = 26) (Mean ± SD)	PDD group (<i>n</i> = 12) (Mean ± SD)	NC group (<i>n</i> = 19) (Mean ± SD)	χ^2 or <i>F</i>	Multiple comparisons
Boys : Girls, <i>n</i>	25:1	11:1	18:1	0.33	
Onset age (years)	12.5 ± 2.7	9.3 ± 3.1	12.4 ± 2.5	6.51*	PDD < ADHD, NC
Unsocialized type, <i>n</i> (%)	7 (26.9)	8 (66.7)	5 (26.3)	6.66*	PDD > ADHD, NC
Comorbid with ODD, <i>n</i> (%)	15 (57.7)	5 (41.7)	4 (21.1)	6.05*	ADHD > NC
FIQ	89.6 ± 10.1	88.1 ± 11.6	96.1 ± 13.1	2.77	
ACE score	1.8 ± 1.7	1.1 ± 1.1	1.6 ± 2.1	0.66	
CD criteria	6.9 ± 2.6	5.8 ± 3.2	5.8 ± 2.8	1.03	
Aggression to people and animals	2.2 ± 1.4	1.4 ± 1.9	2.0 ± 1.7	1.01	
Destruction of property	0.4 ± 0.5	0.5 ± 0.7	0.3 ± 0.5	0.77	
Deceitfulness or theft	1.7 ± 1.2	2.3 ± 1.1	1.6 ± 1.0	1.82	
Serious violations of rules	2.5 ± 1.5	1.5 ± 1.2	2.0 ± 1.1	2.72	

* $P < 0.05$. † χ^2 test; ‡ F test.

ACE score, adverse childhood experiences score; ADHD, attention-deficit-hyperactivity disorder; CD criteria, no. corresponding items in the diagnostic criteria for conduct disorder; FIQ, full-scale IQ; NC, not comorbid with ADHD or PDD; ODD, oppositional defiant disorder; PDD, pervasive developmental disorder.

Table 2 shows the profiles of the three groups. The mean onset age of the PDD group was 9.3 ± 3.1 years, which was significantly younger than that of the other two groups ($F = 6.51$, $P = 0.003$). Of this group, 66.7% (eight of 12 subjects) had the unsocialized type. It occurred more frequently ($\chi^2 = 6.66$, $P = 0.036$) compared with the other two groups. The ADHD group comorbid with ODD more frequently compared with the NC group ($\chi^2 = 6.05$, $P = 0.049$). There were no significant differences between the three groups with respect to FIQ, ACE scores and CD criteria.

DISCUSSION

ADHD and PDD comorbid with CD

In the present study we hypothesized that the comorbidity of PDD with CD was more common than has been previously thought. The frequency of ADHD comorbid with CD in the present study was 45.6%, which is consistent with the results of previous studies.^{1,6} In contrast, the present study found that PDD is comorbid in 21.1% of children with CD, which is higher than reported by Siponmaa *et al.*² One explanation for this is that the present study not only included subjects with CD resident in correctional institutions for offenders in their late teens, but also included children under 14 years of age who were institutionalized or who had visited the hospital on an outpatient basis. Another reason for the high comorbidity of PDD in the present study is that a careful diagnostic process was followed by experienced child psychiatrists. Such a process led us to diagnose 12 children with PDD, 11 of whom had not been diagnosed prior to the present study.

Based on our experiences, PDD comorbid with CD seems to be relatively mild, and mild PDD is difficult to diagnose, which may account for the fact that their existence among CD children has attracted little attention. De Bruin *et al.* administered the Diagnostic Interview Schedule for Children-IV-P to 94 clinically referred children with PDD-NOS aged 6–12 years.⁷ They found that 37.2% of the children had comorbid ODD and 9.6% had CD.

The high comorbidity of ODD and CD with ADHD is thought to be due to poor impulse control, social cognitive disorder, and executive dysfunction observed in ADHD. These, however, are features also found in PDD.^{8,9} Luteijn *et al.* showed that children with ADHD and children with PDD-NOS both had severe problems in executing appropriate social behaviors.¹⁰ It is inferable that PDD may be comorbid with ODD and CD for the same reason that ADHD is comorbid with them.

Moreover, children with PDD may commonly be ignored by their peers due to their difficulties with

interpersonal relationships and social cognitive disorder. This may be the reason why unsocialized type CD was more frequent in the PDD group.

The present results suggest that it is not rare for PDD to be comorbid with CD, and thus clinicians should be aware that not only ADHD but also PDD may be comorbid with CD.

Overlapping hyperactivity and inattention symptoms in ADHD and PDD comorbid with CD

Of the 12 children who met the diagnostic criteria for PDD, six also met the diagnostic criteria for ADHD. This affirms the assumption that overlapping conditions of ADHD and PDD are more frequent than recognized.

Many investigators have noted the overlap between ADHD and PDD. De Bruin *et al.* found that 44.7% of clinically referred PDD-NOS had comorbid ADHD.⁷ Jensen *et al.* found that 74% of children with PDD-NOS had previously been diagnosed solely with ADHD.¹¹ Lee and Ousley reported that of 83 children with autistic spectrum disorder, 78% fulfilled DSM-IV criteria of ADHD,¹² while Yoshida and Uchiyama reported that 85% of individuals with Asperger's disorder/PDD-NOS also met the DSM-IV criteria for ADHD.¹³ Luteijn *et al.* showed that attention problems did not differ between children with ADHD and children with PDD-NOS, indicating a high degree of overlap between the features of ADHD and PDD.¹⁰ Consequently, Clark *et al.* have cautioned that children suffering from ADHD should also be assessed for symptoms of PDD.¹⁴

Although restlessness and inattention in children's behavior are recognized without difficulty, a problem with interpersonal relationships, which is not easily observed in their behavior, is not easily recognized. Therefore, clinicians must keep in mind that patients who present features of ADHD must be carefully assessed to distinguish PDD features, otherwise patients with both PDD and ADHD symptoms may be misdiagnosed as having ADHD due to their prominent ADHD symptoms. The present results suggest that PDD comorbid with CD must be considered as a differential diagnosis and must carefully be excluded before diagnosing ADHD comorbid with CD.

Differences of CD according to type of comorbid behavioral/developmental disorder

The present study showed the tendency for CD comorbid with PDD to have earlier onset. It has been considered that childhood-onset CD tends to be comorbid with ADHD and that such cases involve a poor prognosis such as antisocial personality disorder.^{1,15} The present results, however, suggest that childhood-onset CD is comorbid with not only ADHD but also PDD, and that the poor prognosis in part may have been due to the PDD features.

Soderstrom *et al.* compared total and factor Psychopath Checklist Revised (PCL-R) scores to Axis I disorders and Axis II personality disorders.¹⁶ The total PCL-R scores as well as the scores for Factor 2 (unemotionality) and Factor 3 (behavioral dyscontrol) were significantly correlated with Asperger's syndrome/high-functioning autistic traits, as well as ADHD, CD, substance abuse, and Cluster B personality disorders of DSM-IV.

The present results also showed that ACE scores and behavioral symptoms of CD did not differ between types of behavioral/developmental disorders comorbid with CD. This means that both children who have CD comorbid with ADHD and with PDD have similar adverse childhood experiences, which might cause CD, and conduct behaviors as a result. This may have also complicated the differentiation of CD comorbid with ADHD and with PDD. Greater attention and follow-up studies are warranted to clarify the prognosis of CD comorbid with PDD.

Importance of PDD diagnosis

As aforementioned, executive dysfunction is presumed to be present in PDD.^{8,9} Children with PDD have difficulty planning ahead by predicting the future and correcting their behavior by reflecting on their own past behaviors. Therefore, their problem-solving skills are poor and they have difficulty in correcting antisocial behaviors that they have already developed. Adults around them have difficulty understanding their behaviors because they have idiosyncratic ideas and cognition. They may not understand the association between cause and effect, which makes it difficult for them to reflect on themselves and feel guilt. Consequently, they may not understand instruction and may repeat antisocial behaviors. In correctional institutions such characteristics may be regarded negatively as audacious, inexplicable, and unrepentant. Some children with PDD, however, may adjust surprisingly well to the structured life in institutions. These characteristic features are easily understandable if the diagnosis of PDD is already given. If not, at the other extreme, they may need to be controlled unnecessarily strictly or, conversely, may not receive necessary instructions sufficiently. Appropriate diagnosis enables them to receive appropriate instructions and guidance, which may in turn improve their prognosis.

Limitations

In order to increase the accuracy of diagnosis, all subjects were interviewed rather than assessed using diagnostic checklists. Consequently, we were unable to increase the number of subjects, and statistical examination was

performed with relatively small numbers. It must be noted that the present results must be re-examined with a larger number of subjects.

Even allowing for the low prevalence of CD in girls, the number of girls in the present study was relatively small. One reason for this is that one of the institutions from which the participants were recruited was for boys only. It has been indicated that girls with CD have specific characteristics,¹⁷ and it is necessary to increase the sample size of girls in future studies.

CONCLUSION

Although ADHD has previously been emphasized as a behavioral/developmental disorder comorbid with CD, there are substantial numbers of children with CD comorbid with PDD. The overlapping of ADHD and PDD is frequent, and clinicians should take into consideration the possibility of PDD being comorbid with CD. Establishment of the correct diagnosis is important because recognizing the presence of PDD will enable us to provide appropriate treatment and guidance, which may improve prognosis.

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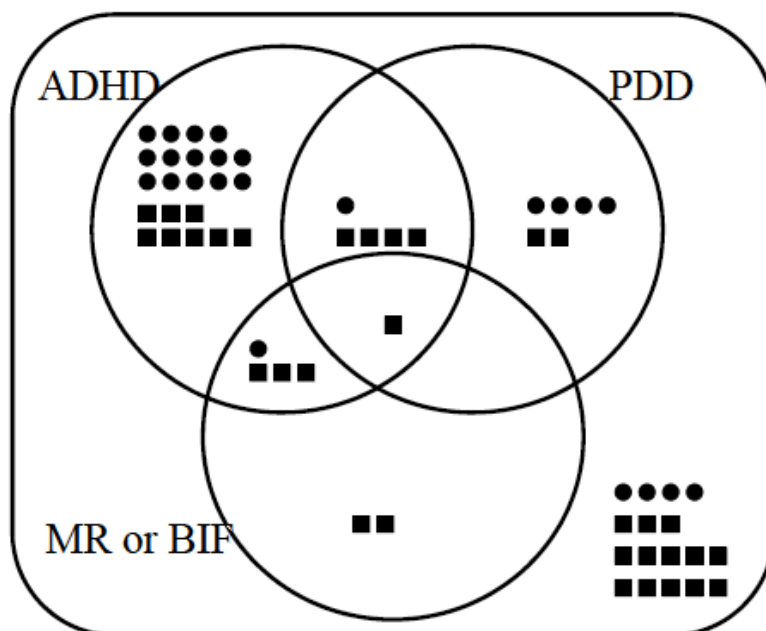


Figure 1. Comorbid behavioral and developmental disorders of children with conduct disorder. (●) Oppositional defiant disorder; (■) absence of oppositional defiant disorder. ADHD, attention-deficit–hyperactivity disorder; BIF, borderline intellectual functioning (full-scale IQ between 70 and 79); MR, mental retardation; PDD, pervasive developmental disorder.