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Persistent emotional disorder in children with neurological soft signs

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Case Study

Persistent Emotional Disorder in Children with Neurological Soft Signs

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Abstract. Objective: This paper provides clinical details in the form of case vignettes from a prospective epidemiological study that found the combination of childhood "soft" signs and anxious behavior to be a strong risk factor for adolescent emotional disorders. Method: The original study conducted a neuropsychiatric assessment of adolescents who had been followed through childhood. Results: The at-risk subjects are shown to exhibit a persistent and specific pattern of both motor abnormalities and anxiety, obsessional compulsive, or depressive symptoms over time. Discussion: The form of their neurological and psychiatric abnormalities is consistent with neuropsychiatric research linking motor system abnormalities to emotional disorders. It is recommended that children who present with anxious and depressive symptoms be examined for motor soft signs. *J. Am. Acad. Child Adolesc. Psychiatry,* 1993, 32, 6:1229–1236. **Key Words:** soft signs, anxiety, depression, neurologic abnormalities, child and adolescent psychiatric disorders.

The co-occurrence in early childhood of certain neurological soft signs with anxious, withdrawing behaviors was found by Shaffer and colleagues (1985) to be strongly predictive of anxious, affective, and obsessional symptoms that persist through adolescence and early adulthood causing significant impairment (Hollander et al., 1991). This effect was independent of IQ and social environment. Children who displayed similar anxious behaviors at age 7 years but who lacked soft signs were no more likely than nonanxious controls to exhibit such later-life psychiatric disability. Nonanxious 7 year olds with soft signs were only slightly more likely than controls without soft signs to develop adolescent psychiatric disorders.

Soft signs present at age 7 were principally abnormalities of motor coordination, such as irregular performance of finger-to-finger opposition or rapid alternating movements. The later psychiatric symptoms comprised anticipatory and separation anxiety, dysthymic and depressive symptoms, obsessions or compulsions, and recurrent suicidal ideas. The report presented one of the few longitudinal studies to have demonstrated persistence of anxiety symptoms through childhood, and it identified a subgroup of anxious children with a particularly poor prognosis. The study also represented the only broad-based and long-term psychiatric examination of children with soft signs but without frank neurological disorders.

The attributable effect was strong so that within the study sample 40% of all 7 year olds with the combination of soft signs and a high score on the anxiety scale suffered persistent and impairing anxiety symptoms into adolescence (odds ratio 19.3; $p < 0.001$). Furthermore, many of these subjects displayed significant comorbid affective symptoms, and just less than 50% suffered either adolescent anxiety or affective disorders. All girls and 12 of 15 boys who developed age 17 anxiety disorders had exhibited age 7 soft signs. Among boys, early soft signs independently predicted the development of affective disorders ($p < 0.01$). Compatible findings were obtained from a cross-sectional analysis of a different and larger cohort ($n = 537$) of 7 year olds.

For a number of reasons the findings were believed to be robust. The effect was large and replicated in three different samples of reasonable size (Shaffer et al., 1985). A positive dose-response relationship was noted independently in both genders, such that children with more signs were more likely to manifest psychiatric abnormality. The sample was selected from the community, eliminating confounders between behavior problems and help-seeking behavior, which could be a factor in studies of referred children. The predictor measures were collected at a preceding point in time and without knowledge of the purpose of this study. Furthermore, the association between abnormal motor coordination and emotional symptoms in this study seemed plausible in the light of recent findings among patients with basal ganglia abnormalities (Insel, 1992; Starkstein et al., 1990).

The findings suggested that young anxious children fall into two groups differing with respect to neurological status and that these groups have a markedly different prognosis. If these findings are replicated, it should be possible to identify and possibly treat children who would otherwise have a chronic and handicapping course of disorder. The initial study reports presented only summary data and provided few clinical details (Shaffer et al., 1983; 1985). The purpose of this report is to present clinical vignettes of subjects who were at highest risk (having both anxious behaviors and soft signs at age 7), describe their course and mental status at the time of the comprehensive age 17 evaluation, and place these findings in the context of recent neuropsychiatric research. It is hoped that this presentation will

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alert the profession to this important entity and make it easier for clinicians to identify similar children presenting for treatment.

Methods

Sample

Subjects were drawn from the 1962 to 1963 Columbia Presbyterian Medical Center (CPMC) birth cohort of the Collaborative Perinatal Project (CPP). The sample frame originally comprised every fifth woman registering during pregnancy at the CPMC prenatal clinic. Systematic records were maintained of prenatal status, delivery, along with developmental, psychological, and neurological status shortly after birth and at ages 4 and 8 months; 1, 3, 4, and 7 years.

One hundred eighty African-American subjects were selected for the present follow-up study on the basis of their neurological status at age 7. The selection of African-Americans was based on their having the highest prevalence of soft signs in the CPMC sample, although this was not true for the multisite study as a whole. Index cases had received a positive rating on any one of eight neurological soft signs but were free of frank neurological disease or mental retardation (IQ $\leq$ 60). Gender-matched controls with no neurological abnormalities at age 7 were chosen from the CPP register. Subjects with and without soft signs did not differ on a number of material variables.

Of the 126 boys selected for study, 118 (94%) were examined between ages 16 and 18 years. Of the 54 girls selected, 48 (87%) were examined between the ages of 17 and 18 years. Two male probands refused examination, and three were excluded because they were found to have frank neurological disorders; three male controls were not located, and three refused examination. One female proband and five controls refused examination, and another was excluded owing to an IQ in the mentally retarded range.

Neurological Assessment

Neurological examinations that included tests for 18 soft signs were conducted at age 7 according to the CPP protocol (Berendes, 1966) by Board-certified pediatricians supervised by senior pediatric neurologists. Agreement on retest was 85% for the most frequently diagnosed signs (poor coordination) (Nichols and Chen, 1981). The neurological examination used in the age 17 study employed similar categories, but tests were operationalized to enhance reliability and to obtain a quantitative measure wherever possible. The examination, conducted by Board-certified pediatric neurologists blind to all other data, had satisfactory interrater and test-retest reliability (Stokman et al., 1986).

Many motor signs were assessed by observing children during the following tasks: finger-to-nose and finger-to-finger opposition, sequential opposition of thumb to same-hand fingers, rapid sequential pronation/supination of the hand, and alternating toe/heel tapping. A child was considered to have soft signs if he or she displayed abnormalities in smoothness, fluency, rhythm, or speed during any of these tasks. Other motor signs were assessed by evaluating children during gait, tandem gait, and hopping exercises, along with stance in the Romberg position. A child was also considered to have soft signs if he or she displayed abnormal involuntary or dystonic movements, awkwardness, or poor coordination during any of these tasks.

Behavioral Measures at Age Seven

Subjects were classified on the basis of a multiitem behavior rating scale completed by the examining psychologist, blind to all other data, during age 7 cognitive testing. Several subscales were constructed from the measures, but only the anxiety/withdrawal (AW) scale (Cronbach's α -0.71) was significantly related to initial neurological status. The AW scale rated 10 behaviors during testing: (1) appearing fearful and apprehensive, (2) appearing exceptionally shy and withdrawn, (3) appearing emotionally flat without changes in facial expression, (4) withdrawing when frustrated, (5) manifesting a need for attention and help, (6) appearing to lack self-confidence or making self-critical comments, (7) preservative behavior, (8) low activity level: passive, placid, and sluggish, (9) rigidity with difficulty in shifting activities, (10) little or no verbal communication. The range of possible scores was zero (low anxiety) to 20 (maximal anxiety). Initial behavioral status as AW was determined by an examination of the distribution of this scale for the entire CPMC cohort of Afro-American and Caucasian children (n = 440). The point of discontinuity lay between a score of 3 and 4. Subjects were designated AW if their score totaled 4 or more. The mean score of the cases presented in this paper was 5.9 with a range from 4 to 12.

Psychiatric Measures at Age 17

The psychiatric evaluation of the adolescent subjects was based on semistructured interviews of both the adolescent and the parent. Interviewers were blind to all other study data. The interview derived items from: the Schedule for Affective Disorders and Schizophrenia (Spitzer, 1977) a psychiatric assessment interview developed by Rutter and Graham (1968), as well as a number of elements designed to elicit symptoms of *DSM-III* diagnoses not covered in either instrument. History was gathered concerning physical and emotional functioning during the period between age 7 and age 17 contacts. At the end of each adolescent or informant interview, the interviewer rated overall functioning on the Child Global Assessment Scale (CGAS). In a subsample of nine subjects, there was 79% agreement between six to nine raters on whether a subject should be assigned a CGAS score greater or less than 70, the score that has been used to distinguish between psychiatrically impaired and normal children (Bird et al., 1987). All subjects with a CGAS score of 70 or less were assigned as many *DSM-III* Axis I diagnoses as appropriate by the best-estimate method in a committee of two senior child psychiatrists and one senior psychologist.

Selection and Preparation of Cases as Clinical Vignettes

Case vignettes were prepared from age 7 psychological behavioral ratings, age 17 interviews and exams, Conners' Teachers' Questionnaires (1969), and clinical summaries integrating this data. Data from age 7 and age 17 contacts,

as well as descriptions at age 17 of the 10 years between contacts, was used to construct these vignettes. Vignettes were prepared for all subjects who scored 4 or more on the AW scale at age 7 years, who had early soft signs, and who received either an anxiety/withdrawal or affective diagnosis at age 17 follow-up. One such case in the original report was not selected because additional review suggested that this subject suffered from overt neurological impairment (i.e., gross motor delay). The mean CGAS scores of these cases was 56.8, (range 45 to 69; normal range 70 to 100). Every subject with age 7 signs and anxiety who developed an AW or affective disorder by age 17 also had persistent neurological signs.

Findings

FEMALES

Case 1, F.K.

F.K. had an AW score of five at the age 7 evaluation. Positive ratings then were fearfulness, shyness, low confidence, readily frustrated, and needy of attention during testing. She was described by her mother as a "clingy," shy, and isolated child who had difficulty separating. Her mother also described her as an especially "needy" child who could not "get enough loving." She had numerous phobic symptoms including fear of the dark, of buses, trains or airplanes, and she frequently bit her nails "down to the ends." Anxiety symptoms persisted into adolescence; she was fearful of being alone and worried that her mother would be harmed whenever they were separated. She complained of persistent feelings of overall anxiety, exacerbated by rare marijuana use. She also worried about her health and complained of frequent headaches or joint pains that limited her activities.

As an adolescent, she was described as withdrawn and isolated but did engage in verbal and physical fights at home and school. She had a negative history of police contacts or severe behavior disabilities. When interviewed at age 17, she appeared hostile with a notably constricted affect. She reported a recent 10-pound weight loss, decreased appetite, poor concentration, and increased sleepiness but denied dysphoria or suicidal thoughts. Her age 17 diagnosis was overanxious disorder (OAD) (Table 1).

Case 2, S.S.

S.S. had an AW score of four at the age 7 evaluation. Positive ratings then were fearfulness, readily frustrated, needy of attention, and rigidity in behavior style during testing. According to her mother, she was an anxious child who was afraid of crowds and strangers and who did not like to socialize with her peers. S.S. was also restless, having many nervous habits but was well-behaved and attentive. She remained isolated in adolescence, with few friends. Her fear of crowds and strangers persisted, and she also became increasingly concerned with her physical health. She visited multiple physicians for complaints of headaches and stomachaches. At age 15, she visited the emergency room in the middle of the night after an episode of palpitations. Medical evaluation (including EKG) was negative; she denied panic symptoms. At age 16, she saw her pediatrician because of increasing difficulty falling asleep and decline in appetite. On examination at age 17 she was particularly anxious, avoidant, and withdrawn but denied dysphoria or other symptoms of depression. She had a negative history of behavior problems, police contact, or substance abuse. Age 17 diagnosis was schizoid disorder.

MALES

Case 3, K.D.

K.D.'s AW score at age 7 was four. Positive ratings then were fearfulness, low confidence, needy of attention, and hesitation in speaking during testing. According to his mother, he was a shy, self-conscious, withdrawn child, who did most things on his own. Through adolescence, he remained nervous and fearful, saying to Ms. D. that he thought "Skylab will fall on me," and that he feared his family would "go broke." In midadolescence, K.D. began to complain of nightly feelings of panic as he lay awake in bed. He described experiencing sudden panic attacks with dyspnea, palpitations, diaphoresis, and trembling as he dwelt on thoughts of nuclear destruction or life after death. He experienced 21 of such attacks in the 3 weeks before his age 17 interview, and during the day he worried about how he would get to sleep at night.

His parents separated a few months before the interview, and his mother thought K.D. became increasingly dysphoric after the separation. He told his mother that he felt "isolated from the human race" and had frequent suicidal thoughts. When interviewed, he acknowledged dysphoria, with decreased appetite/sleep and poor energy. K.D.'s teachers reported a deterioration in his academic performance. K.D. was a well-behaved child with no history of behavior problems, police contact, or substance abuse. His age 17 diagnoses were adjustment disorder with depressed mood and OAD.

Case 4, E.D.

E.D.had an AW score of four at age 7. Positive ratings then were fearfulness, no variation in emotional tone, and extreme rigidity in behavior (scored as two), during testing. His mother remembered that he was anxious as a young child and often fidgeted but was otherwise well-behaved and attentive. He began repetitively pulling his hair in elementary school and continued to excessively pull or "part" his hair in adolescence.

E.D. developed symptoms of depression as a teenager, which his mother believed resulted from increasing quarrels with his father. When interviewed at 17, he denied having any excessive fears, feelings of nervousness, or panic but stated he was depressed most days for much of the day. Throughout the interview he appeared sad, withdrawn, with psychomotor retardation and preoccupations regarding his family. The interviewer found him depressed, but E.D. denied most mood symptoms. E.D. also admitted to marijuana use three times per week. He had a negative history of police contact. His age 17 diagnoses were adjustment disorder with depressed mood and cannabis abuse.

TABLE 1. *Neurological and Psychiatric Characteristics of 11 Cases*

	Age 7 Soft Signs/Anxiety Withdrawal (AW) Score	Age 17 Soft Signs	Age 17 Diagnosis/CGAS
Case 1, (female) F. K.	Dysdiadochokinesis. AW score—5	Dysdiadochokinesis; abnormal gait; athetosis in Romberg; mirror movements; mixed dominance.	Overanxious disorder with unremitting nail-biting; hypochondriacal tendencies; CGAS 64.
Case 2, (female) S. S.	Poor coordination; dysdiadochokin. AW score—4	Poor coordination; dysdiadochokin; abnormal gait; pronator drift/athetosis in Romberg; mirror movements; mixed dominance.	Schizoid disorder; hypochondriacal tendencies; CGAS 58.
Case 3, K. D.	Poor coordination; dysdiadochokin. AW score—4	Poor coordination; dysdiadochokin; abnormal gait; mirror movements; mixed dominance.	Overanxious disorder (with panic attacks); adjustment disorder with depressed mood; CGAS 58.
Case 4, E. D.	Dysdiadochokinesis. AW score—4	Dysdiadochokinesis; mirror movements; mixed dominance.	Adjust. disorder with depressed mood; cannabis abuse; overanxious tendencies/hair-pulling; CGAS 69.
Case 5, D. H.	Poor coordination; dysdiadochokinesis. AW score—4.	Poor coordination; dysdiadochokinesis; abnormal gait; athetosis in Romberg; mirror movements; mixed dominance.	Major depression; conduct disorder; secondary enuresis; substance abuse disorders; social phobic tendencies; CGAS 45.
Case 6, F. N.	Poor coordination; dysdiadochokinesis; astereognosis. AW score—5.	Poor coordination; dysdiadochokinesis; dystonic posturing during gait; mirror movements.	Dysthymic disorder; schizotypal personality; hypochondriacal, obsessive compulsive tendencies; CGAS 47.
Case 7, H. K.	Poor coordination; dysdiadochokinesis; mirror movements; astereognosis; AW score—5.	Poor coordination; dysdiadochokinesis, dystonic posturing with gait; pronator drift/athetosis in Romberg.	Overanxious disorder; obsessive compulsive and depressive tendencies; CGAS 55.
Case 8, N. D.	Poor coordination; dysdiadochokinesis. AW score—6	Poor coordination; dysdiadochokinesis; athetosis in Romberg; mirror movements; agrafethesia.	Avoidant disorder (panic attacks); dysthymic disorder; secondary enuresis; hypochondriacal; social and simple phobic tendencies; CGAS 55.
Case 9, B. N.	Poor coordination. AW score—8	Specific signs not available but were present.	Avoidant disorder; overanxious disorder; CGAS 52
Case 10, S. V.	Astereognosis. AW score—8	Dysdiadochokinesis; athetosis and pronator drift in Romberg; mirror movements; mixed dominance.	Overanxious disorder (panic attacks); alcohol abuse; hypochondriacal and o-c tendencies; hair-pulling; CGAS 65
Case 11, H. O.	Poor coordination. AW score—12	Poor coordination; dysdiadochokinesis; mirror movements; mixed dominance.	Overanxious disorder; adjustment disorder with depressed mood; conduct disord; hypochondriacal tendencies; CGAS 57

Case 5, D.H.

D.H.'s AW score was four at age 7 years. Positive ratings then were extreme fearfulness (scored as two), shyness, and hesitation in speaking during testing. His mother remembered him as a fearful child who was also irritable, having severe conduct problems. He was placed in a residential treatment home at age 9, and he set a fire at this home. D.H. developed persistent enuresis at age 12, after being dry as a child. After returning to his family, he was arrested for stealing his teacher's coat and then for selling drugs. He was incarcerated shortly after his age 17 interview. At that interview, D.H. related that he had long been afraid of large crowds and of being left alone; he tolerated these situations but avoided them. He complained of extreme sadness for the previous month, associated with increased sleep, fatigue, decreased appetite, 10-pound weight loss. He felt "slowed down" but denied suicidal ideation, hallucinations, or other

psychotic symptoms. He admitted to getting in frequent fistfights. He was seen by the interviewer as an angry, depressed individual.

D.H. had a no history of attention-deficit hyperactivity disorder (ADDH) symptoms and did not appear distractible as a 17 year old. He reported frequently using marijuana, cocaine, and PCP. His diagnoses were major depression, conduct disorder, secondary enuresis, and substance abuse.

Case 6, F.N.

F.N. had an AW score of five at age 7. Positive ratings then were: fearfulness, no variation in emotional tone, and extreme rigidity in behavior (scored as two), during testing. According to his father, he was a very anxious and peculiar child who often obsessed about one idea; he had few friends and many fears. He was also impulsive, hyperactive, and inattentive; as a result, he was placed in a school for behaviorally disabled children. Although these problems diminished in adolescence, his symptoms of peculiarity, isolation, and anxiety persisted. As a teenager, he lived with his father who described his son as lonely and isolated with virtually no friends. F.N. often worried about his father's health, fearing that he would suddenly die and leave him an orphan. He felt anxious on separation from his father and repeatedly asked his father to refrain from going out at night. F.N. was afraid of crowds, avoiding them whenever possible, and he expressed worries about his physical health, stating he was afraid he "caught" diabetes. When F.N. was anxious he would take out his large collection of toy cars and arrange them in a specific pattern for several hours, until asked to stop. He would revert to this activity if given the opportunity.

Since early adolescence F.N. suffered from recurrent monthly dysphoric episodes. He would appear depressed for days, slumped in a chair, looking sad for much of the day. There were no vegetative symptoms or suicidal ideas during these episodes.

F.N. did not exhibit ADDH symptoms when interviewed. He had no history of police contact or substance abuse. His diagnoses were dysthymia and schizotypal personality disorder.

Case 7, H.K.

H.K. had an AW score of five at his age 7 evaluation. Positive ratings then were extreme fearfulness (scored as two), shyness, needy of attention, and rigidity in behavior during testing. According to his mother, he was a very bashful and isolated child, who preferred the company of younger children and who was so self-conscious that he "only talked to others when he had to." H.K. said that he was afraid his peers did not accept him and often said they were against him. As an adolescent he remained shy and anxious with frequent worries about the future. He had few friends and often was teased by his peers. When interviewed at 17, H.K. reported frequently feeling anxious and tense, especially in crowds, which he tried to avoid. When he felt anxious, H.K. performed rituals, checking things over and over and said this relieved his internal tension; he had trouble putting these thoughts out of his mind.

In adolescence, H.K. grew increasingly irritable, especially around his father. Ms. K. felt that her son often seemed sad, withdrawn, and uncommunicative. When interviewed, H.K. admitted to feeling depressed many days with occasional mood swings but no episodes of mania. He described trouble sleeping due to frequent awakenings, recent recurring thoughts of suicide but no problems with appetite or weight loss or concentration. The interviewer thought he appeared anxious or depressed with constricted affect and soft speech. H.K. had a negative history of behavior disability, police contact, or substance abuse, and his age 17 diagnosis was OAD.

H.K. was interviewed again at age 27, as part of a limited adult follow-up study. At this time, he was diagnosed with obsessive-compulsive disorder, major depression, an eating disorder, generalized anxiety disorder, and nine other Axis I diagnoses.

Case 8, N.D.

N.D. had an AW score of six at 7 years old. Positive ratings then were extreme fearfulness (scored as two), shyness, low confidence, readily frustrated, and hesitation in speaking during testing. Throughout childhood he was seen by his mother as a "loner" and a "worrier," who had fears of animals and strangers and who was particularly concerned with his physical health and with the mental health of his family members. These fears and associated avoidance persisted into adolescence. He was an isolated teenager who refused to attend social events, suffering panic in such situations. He had episodes where he spent hours in his room sleeping during the day. He also had difficulty concentrating and changes in appetite or sleep patterns; he often appeared sad. He had developed secondary enuresis at age 15 after being dry since age three. On examination at age 16, he appeared overly suspicious with a constricted affect. He admitted to frequent short-lived feelings of loneliness, guilty ruminations, and self-pity.

N.D. had a negative history of behavior problems, police contact, or substance abuse. His diagnoses were avoidant disorder, dysthymia, and secondary enuresis.

Case 9, B.N.

B.N. received an AW score of eight at his age 7 years evaluation. Positive ratings then were extreme fearfulness (scored as two), shyness, low confidence, needy of attention, placid or inactive, hesitation in speaking, and little variation in emotional tone during testing. His mother remembered him as a shy child. As an adolescent he remained anxious, specifically about the dark, and he continued to need a light illuminated at night to sleep. Beginning at age 15, B.N. often refused to attend school.

In adolescence, B.N. was regularly irritable a few times each week. During these times he would throw things, slam doors, or "go to his room to cool off," and he ran away from home more than five times in the year before his age-16 interview. He denied feelings of dysphoria, suicidality, decreased concentration, or vegetative symptoms.

B.N. had a negative history of hyperactivity, police contact, or substance abuse. His diagnoses were OAD and avoidant disorder.

Case 10, S.V.

S.V. had an AW score of eight at age seven. Positive ratings then were extreme fearfulness (scored as two), shyness, low confidence, little variation in emotional tone, placid or inactive, hesitation in speaking, and a rigidity in behavior during testing. His mother remembered him as an anxious, restless child, who would "rock and swing, back and forth" when nervous. As an adolescent, S.V. worried excessively and often pulled his hair when nervous. He was isolated and was afraid that others were against him. S.V. saw a psychiatrist in early adolescence because of frequent headaches and leg pains that interfered with his concentration, along with fears that he was growing too fast. From early adolescence, S.V. obsessively counted his money over and over each morning and afternoon; he did this at least three times each day. This behavior interfered with his daily activities: he was often late for school. He had one police contact for truancy.

S.V. was regarded as particularly stubborn and rigid. He had daily arguments with family members and often was irritable. When interviewed at age 16, S.V. reported experiencing regular panic attacks with palpitations on meeting strangers. He also complained of severe anxiety in crowded places such as subways, which he avoided. He reported only occasional feelings of dysphoria, usually associated with one of the frequent headaches or leg pains he suffered. He denied changes in appetite, sleep pattern, ability to concentrate, or any suicidal feelings.

S.V. admitted to drinking alcohol many days of each week, sometimes even before breakfast, occasionally also using marijuana. He had a negative history of severe behavior disability. His diagnoses were OAD and alcohol abuse.

Case 11, H.O.

H.O. had an AW score of 12 at age 7. Positive ratings then were extreme fearfulness (scored as two), shyness, low confidence, preservation, no variation in emotional tone (scored as two), hesitation in speaking, easily frustrated, very inactive or placid (scored as two) and rigidity in behavior during testing. According to his mother, he had always been a tremendous worrier. This persisted into adolescence, and he "fussed" frequently about whether the family would have enough money to eat. When he was interviewed at 17, H.O. expressed concern about his mother's physical health. He also related that he suffered from frequent headaches and other vague medical symptoms that limited his activities.

H.O. was a moody, occasionally depressed adolescent who had at least weekly half-hour episodes of sobbing in his room. His mother thought these episodes had been precipitated by increasing arguments in the home. He would often break some of his belongings during one of these episodes. He experienced regular insomnia and subsequently had difficulty getting out of bed a few days each week. H.O. exhibited growing oppositionality in adolescence. Ms. O. received increasing complaints from his school concerning episodes of talking back to teachers and failing grades. She related that H.O. was stubborn and lazy at home. When interviewed at age 17, H.O. admitted to a week-long period of dysphoria, associated with decreased sleep, anhedonia, feelings of worthlessness, trouble concentrating, and weight loss; he denied suicidal thoughts and appeared generally withdrawn and uncommunicative. His diagnoses were OAD, adjustment disorder with depressed mood, and conduct disorder.

Discussion

Clinical Implications

This paper describes 11 subjects from a nonreferred sample who had a combination of neurological "soft signs" and anxiety symptoms in early childhood persisting through late adolescence. The subjects were part of a study that identified a powerful predictive relationship in a longitudinally followed community sample and the importance of the findings derived from the robustness of the original study design. The original report provided little clinical detail, instead emphasizing the magnitude of risk associated with early anxiety and soft signs. This paper presents previously unreported clinical information to convey the flavor of psychopathology among at-risk subjects. The findings suggest that an evaluation of motor signs in young children with anxiety or affective symptoms may have prognostic significance for the persistence of disorder.

The most common behaviors observed in the above subjects at age 7 years were: fearfulness (in 11/11 subjects), hesitation in speaking (8/11), and seeming shy, not confident, or self-critical (7/11). At age 17, subjects demonstrated features of at least two (and often four or five) distinct *DSM-III* disorders. The most common diagnoses were anxiety/withdrawal or affective disorders, and each subject suffered at least one such disorder. Frequently reported adolescent symptoms were social withdrawal (in 8/11 subjects); dysphoria, sleep, and appetite disturbance (7/11); agoraphobia (6/11); and hypochondriacal symptoms (6/11). Two subjects also suffered comorbid conduct disorder; two others reported significant substance abuse; and another had a childhood history of ADDH. Rates of conduct disorder and hyperactivity, however, were lower in this group than in controls. Three subjects reported regular panic attacks; three displayed recurrent obsessions and compulsions; and two had recurrent suicidal ideation.

Besides obsessions/compulsions, three subjects had symptoms of recurrent hairpulling (cases 4 and 10) and nail-biting (case 1), considered by some as related to OCD (Leonard et al., 1991; Swedo et al., 1989). Obsessions/compulsions and other repetitive behaviors were considered associated features of general fearfulness, isolation, depression, and anxiety. Although subjects failed to meet criteria for OCD, evidence suggested that such adolescent symptoms may have been a prelude to the full OCD syndrome (Berg et al., 1989; Hollander et al., 1991).

Previous soft sign research in children focused primarily on relationships with disruptive behavior disorders rather than emotional disorders. These studies examined small

clinically referred samples and used less-comprehensive behavioral evaluations. That we found a strong relationship with emotional disorders and a weak one with hyperactivity/disruptive disorders is not inconsistent with other research among nonreferred samples. Nichols and Chen (1981) found only a small excess of hyperactivity or inattention in children with soft signs.

Biological Considerations

The term "soft sign" has been applied loosely to diverse abnormalities in the neurological examination, but the present study limited its use to a variety of apraxias as well as involuntary movements elicited in the Romberg position. Most signs were reliably detected and relatively stable over time (Shafer et al., 1986; Stokman et al., 1986). Although these signs traditionally were considered the consequence of perinatal injury, prospective longitudinal and twin studies among the entire CPP sample suggested they may be heritable phenomena only marginally related to perinatal factors (Nichols and Chen, 1981).

A causal relationship was suggested by the dose-response relationship between number of soft signs and risk for emotional disorder, although the mechanism of this relationship was not clear. It is possible that anxiety led to poor performances on the neurological examination, but this seemed unlikely for a number of reasons. If the association between anxiety and soft signs was due to test anxiety interfering with neurological performance, the group of 7 year olds with anxiety and soft signs would include a number of children who would have been classified as neurologically normal if they had not been nervous at testing. This group should then resemble the neurologically normal 7 year olds at follow-up rather than the group with soft signs but no anxiety. However, the children with anxiety and soft signs at age 7 were more likely to still have neurological signs at age 17, and they also had significantly lower IQ-scores, perhaps a marker for neurological impairment. Finally, if anxiety mediated both psychiatric and neurological outcome, one would expect anxiety and signs to be strongly associated at age 17, but soft signs at age 7 were more predictive of psychiatric status at age 17. Based on these observations and in light of recent research, neurobiological factors seemed a more plausible mediator, and it is possible that both emotional and neurological abnormalities arose from a common neural substrate.

The pattern of neurological signs in the above subjects (Table 1) suggested disorders of the basal ganglia. A relationship between basal ganglia dysfunction and emotional disorders was found in recent research among both neurological and psychiatric patients. Studies in patients with neurological diseases documented an increased risk for affective, anxiety, and obsessive-compulsive disorders (OCD). LaPlane et al. (1989) described the de novo development of an affective, obsessive-compulsive, and frontal lobelike syndrome in eight patients after they suffered localized injury in the lentiform nucleus as demonstrated by neuroimaging. Starkstein et al. (1990) reported a significant and specific increase in major depression after computerized tomography (CT) confirmed basal ganglia infarction, most notable after left-sided lesions. Dening and Berrios (1989) assessed a series of 195 cases of Wilson's disease retrospectively, documenting evidence of psychopathology in 51% of the patients, about half of whom suffered affective disorders. Psychiatric symptoms were most common in patients with bulbar (dysarthria, dysphagia) and dystonic abnormalities. Stein et al. (1990) documented an association between Parkinson's disease and anxiety disorders. Cummings (1992) reviewed extensive literature demonstrating an increased risk for affective disorders among patients with Parkinson's disease, and he concluded that depression results from dysfunction in the neural pathways connecting the basal ganglia with the cortex. Among children, Swedo et al. (1988) reported an increased prevalence of OCD in subjects with histories of Sydenham's chorea, as compared with subjects with histories of chorea-free rheumatic fever. Finally, Mayeux (1983) reviewed the extensive literature elsewhere on the emotional correlates of these and other basal ganglia disorders, including progressive supranuclear palsy and Huntington's disease. He concluded that motor and emotional sequelae of basal ganglia disease result from alterations in shared neural pathways.

Studies among psychiatric patients also demonstrated a relationship between emotional disorders and basal ganglia dysfunction. Wise and Rapoport (1989) reviewed the neuropsychiatric literature supporting a specific association between OCD and basal ganglia abnormalities in children and adults (see above studies in neurology patients). Other studies found associations between motor soft signs and OCD. Hollander et al. (1991) reevaluated eight subjects (including case 7) from the CPP cohort in adulthood and concluded that the combination of early soft signs and anxiety/withdrawal behaviors predicted the development of OCD in adulthood. Recent studies among referred adult (Hollander et al., 1990) and pediatric (Denkla, 1989) OCD patients documented an increased prevalence of similar soft signs. In a review of both structural (CT, magnetic resonance imaging [MRI]) and functional (single photon emission tomography [SPECT], positron emission tomography [PET]) neuroimaging studies in OCD patients, Insel (1992) found strong evidence suggesting involvement of the basal ganglia in the pathophysiology of OCD. There have been fewer neuroimaging studies of patients with anxiety disorders besides OCD, but among 20 patients with generalized anxiety disorder, Vasquez et al. (1988) found significantly decreased metabolism in basal ganglia structures on PET scans, in comparison with 19 normal controls.

Studies among patients with affective illness also demonstrated an association with basal ganglion abnormality (see above studies). Rabins et al. (1991) used MRI to find that elderly depressed patients had an increased number of basal ganglia lesions compared with Alzheimer patients or age-matched normal controls. Similarly, Krishnan et al. (1992) used MRI to show that patients with major depression had significantly smaller caudate nucleus volumes than age and gender-matched controls. Using PET, Baxter et al. (1985) reported that unipolar depressed patients had a significantly decreased ratio of caudate-to-hemisphere metabolic rate when compared with normal controls or depressed bipolar

patients. Buchsbaum et al. (1986) also reported that bipolar patients had significantly lower basal ganglia metabolic rates than did normal controls.

In summary, ample research suggested a relationship between neuromotor and emotional dysfunction. The strong association between persistent neuromotor signs and emotional difficulties in the above 11 subjects seemed plausible when placed in the context of this research.

Conclusions

A limitation of the present study lay in the relatively sparse descriptions of childhood behaviors. Future study should focus on replicating the previous findings, but it also should attempt to broaden the descriptions of early psychiatric status in children with soft signs. It may be helpful to explore familial patterns of both soft signs and psychiatric disorders. The study was completed in a racially homogeneous and largely underprivileged population. However, there were no detectable effects, either direct or indirect, between social-environmental factors and either soft signs or anxiety. Therefore it is likely the findings will generalize to other populations.

The findings from this study have clear implications for diagnosis and prevention in early childhood. Among all children exhibiting age 7 "anxiety/withdrawal" behavior, individuals with soft signs had a significantly worse prognosis than did children without soft signs. It would seem sensible for all children presenting to psychiatrists with clinical profiles similar to the above vignettes to receive examinations for motor soft signs. This potentially could identify those at high risk for persistent disorders. It is not yet clear whether they can be expected to respond well or differentially well to specific treatments.

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