Behavioural inhibition: A predictor of anxiety

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Anxiety disorders are prevalent and contribute to emotional suffering and significant economic loss. Early identification and treatment are essential, not only to reduce the associated morbidity, disability and mortality of the anxiety disorders themselves, but also to minimize development of frequent comorbidities such as depression and substance abuse. To understand the factors that increase susceptibility to developing anxiety disorders, a temperamental construct called behavioural inhibition, which refers to the consistent tendency of some children to demonstrate fear and withdrawal in novel situations, has been developed. The present article reviews studies investigating this model as a premorbid predictor of those at risk for developing anxiety disorders, including prospective studies of children at risk as well as retrospective and family studies. In summary, these data suggest the usefulness of this model and a need for further research to determine the optimal management of behaviourally inhibited children as a potential way to prevent adult psychopathology.

Key Words: *Anxiety disorder; Behavioural inhibition; Children; Temperament*

L'inhibition comportementale : Un prédicteur d'anxiété

Les troubles anxieux sont prévalents et contribuent à la souffrance affective et à une importante perte économique. Le dépistage et le traitement précoces sont essentiels non seulement pour réduire la morbidité, l'incapacité et la mortalité connexes aux troubles anxieux, mais également pour réduire au minimum l'apparition de comorbidités fréquentes, telles que la dépression et l'abus d'intoxicants. Pour comprendre les facteurs qui accroissent la susceptibilité d'apparition de troubles anxieux, une construction mentale du tempérament a été établie, nommée inhibition comportementale, qui désigne la tendance constante de certains enfants à avoir peur et à se retirer dans des situations nouvelles. Le présent article analyse les études examinant ce modèle comme prédicteur prémorbide des enfants vulnérables aux troubles anxieux, y compris des études prospectives d'enfants vulnérables et des études rétrospectives et familiales. Pour résumer, ces données indiquent l'utilité de ce modèle et le besoin de recherches plus approfondies pour déterminer la prise en charge optimale des enfants au comportement inhibé comme moyen potentiel de prévenir des psychopathologies à l'âge adulte.

It is generally believed that anxiety disorders develop through the interplay of biological, psychological and social factors. A genetic predisposition towards heightened anxiety sensitivity, combined with an overappraisal of fear and negative life experiences, may result in clinical anxiety disorders that cause the patient greater impairment as time goes on. People may suffer from anxiety disorders for years before receiving appropriate treatment, resulting in significant morbidity for those who suffer from these disorders (in addition to social and economic costs). Anxiety disorders have a lifetime prevalence of approximately 25% (1), and involve high rates of suicide attempts, ranging from 13% of generalized anxiety disorder patients (2) to 17% in post-traumatic stress disorder patients (3). With such high prevalence, economic impact is substantial, with estimates of annual direct and indirect costs of anxiety disorders in the United States in the range of US$42 billion in 1990 (4) and US$65 billion in 1994 (1). The latter figure includes the cost of physicians, hospitalizations, morbidity, mortality and other related costs (such as social welfare administration). The challenge is, therefore, to identify people who, at an early age, are at increased risk for developing anxiety disorders so that they may be provided with opportunities for treatment. This could facilitate the initiation of potentially preventative measures aimed at precluding the development of an anxiety disorder. The temperamental construct of behavioural inhibition (BI) may be an early identifiable risk factor for anxiety disorders and is therefore useful for targeting children at risk.

In 1984, Kagan and colleagues (5,6) described the concept of BI to the unfamiliar in their study of young children. The study involved 117 children aged 21 months whose behaviour with unfamiliar people and objects was recorded on video. These unfamiliar situations included an initial meeting with an unfamiliar examiner, an encounter with an unfamiliar set of toys, interaction with a female stranger, exposure to a large, odd looking robot and separation from the child's mother. Behavioural signs of BI were recorded. These signs included long latencies before interacting with unfamiliar adults, retreat from an unfamiliar object or person, cessation of play or vocalization, clinging to mother and fretting or crying. The children who consistently exhibited

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signs of either BI or a lack of inhibition were selected to form a group of 28 extremely inhibited and 30 extremely uninhibited children. In the longitudinal study that followed (7), children who had been previously classified as either having BI or being very uninhibited at 21 months of age were reassessed at four years of age in various new 'novel situations' to evaluate behaviour and heart rate variability. The sample consisted of 43 of the original 58 children seen at 21 months of age; within this sample, 22 were previously classified as behaviourally inhibited and 21 as behaviourally uninhibited. At age four years, these inhibited children tended to continue being socially inhibited and displayed a higher and more stable heart rate. As well, these children were more reluctant to guess at difficult problems. Of the 22 children classified as behaviourally inhibited at age 21 months, 13 continued to be very inhibited and nine became less inhibited at four years of age. Of the nine who became less inhibited, five children changed a great deal, suggesting a role for learning and unlearning the BI feature of their interactive style. Thus, the tendency toward behavioural inhibition or lack of inhibition tended to be moderately stable during the preschool years.

Kagan et al (7) continued to follow these children and were able to show preservation of these inhibited or uninhibited behaviours into the sixth year of life. They reported that children with BI who were exposed to novel situations exhibited greater physiological arousal, with accompanying increases in salivary cortisol levels, muscle tension, heart rate and pupillary dilation. They suggested that the threshold for activation of the limbic and hypothalamic systems might be tonically lower for inhibited children.

At seven-and-a-half years of age, Hirshfeld et al (8) reassessed the original group of children (labelled inhibited or uninhibited at 21 months of age). Children found to be consistently inhibited during follow-up at ages four, five-and-a-half and 7.5 years were termed 'stable inhibited', whereas children who were found to be initially inhibited at 21 months, but were not inhibited at one or more of the follow-ups were termed 'unstable inhibited' (8). The sample consisted of 41 of the original 58 children seen at 21 months of age. In total, 12 of the 41 children were classified as stable inhibited, 10 were classified unstable inhibited, nine as stable uninhibited and 10 unstable uninhibited. Interestingly, the stable inhibited children had higher rates of anxiety disorders than those who were not consistently inhibited; eight of the 12 stable inhibited children had one or more anxiety disorders compared with only one of the 10 unstable inhibited children.

In addition, the parents of these stable inhibited children had higher rates of multiple childhood anxiety disorders (25% of parents of the stable inhibited children versus only 3.6% of parents of unstable inhibited children) as well as continuing anxiety disorder into their adulthood (35% of parents of the stable inhibited children versus 7.3% of the parents of the other unstable inhibited children) (8).

The ability to stably retain the symptoms of BI was supported by Schwartz et al (9), who reported on the preservation of BI into adolescence.

A further study by Biederman et al (10) examined risk factors for mood and anxiety disorders. The study found that inhibited children had an increased risk for having more than one anxiety disorder; additionally, they had an increased risk for overanxious and phobic disorders. Among the BI children in this study, 22.2% had two or more anxiety disorders versus 0% in healthy, uninhibited control children. The rate of incidence for overanxious disorder was 27.8% for inhibited children and 0% for controls. BI children had a rate of 31.8% for phobic disorders versus 5.3% for the uninhibited children.

Furthermore, Biederman et al (11) reported that BI in young children from parents with panic disorder or major depression was associated with an increased risk of developing social anxiety disorder (17% in BI children versus 5% in non-BI children).

Additional support for the notion that childhood BI is a risk factor for anxiety disorders later in life came from work undertaken by Rosenbaum et al (12), who found an increased rate of BI in children from parents with panic disorder and agoraphobia (PDA) compared with those from psychiatric comparison groups, including parents with major depressive disorder (MDD), comorbid MDD and PDA, and non-MDD groups. Fifty-six children aged two to seven years were blindly evaluated at the Harvard Infant Study Laboratory. The rate of BI in children with probands of PDA was 84.6%, compared with 70% of those with probands of PDA and MDD, 50% of those with probands of MDD and 15.4% of those with probands of non-MDD. Rosenbaum et al (13) conducted a similar study with a larger sample group of 284 children aged two to six years. It was found that comorbidity of panic disorder and MDD accounted for much of the link between parental panic disorder and childhood BI.

A twin study by Robinson et al (14) examining the heritability of inhibited and uninhibited behaviour in same-sex twin pairs seen at 14, 20 and 24 months of age found that genetic influences accounted for approximately one-half of the variance in behaviour at each age, with heritabilities ranging from 0.51 to 0.64. The remainder of the variance was attributed to nonshared environmental influences.

Further to this point, Rosenbaum et al (15) hypothesized that greater anxiety loading in parents would increase the risk for anxiety disorders in BI children. The rate of parental anxiety disorders was significantly higher when children had both BI and anxiety (68.8% rate of at least two parental anxiety disorders) compared with parents of children with BI only (25% rate of at least two parental anxiety disorders) or parents of children without BI or anxiety (13% rate of at least two parental anxiety disorders). The authors suggested that the presence of parental loading for anxiety disorders could help to identify a subgroup of BI children with an even higher risk of developing anxiety disorders in childhood.

TABLE 1
Morbid risk of Diagnostic and Statistical Manual of Mental Disorders, 3rd edition (26) disorders in parents of inhibited, uninhibited and normal control children in a nonclinical sample

	Child temperament					
	Inhibited (n=40)		Uninhibited (n=35)		Normal control (n=35)	
Anxiety disorders in parents	n	%	n	%	n	%
Any (≥1) anxiety disorder	20	50	10	28.6	5	14.3
Multiple (≥2) anxiety disorders	10	25	3	8.6	0	0
Any (≥1) adult anxiety disorder	12	30	8	22.0	3	8.6
Any childhood anxiety disorder	17	42.5	4	11.4	3	8.6
Continuing anxiety disorder	9	22.5	2	5.7	0	0

Data from reference 16

This notion was supported by a second study by Rosenbaum et al (16). The study found that parents of inhibited children were at significantly higher risk for two or more anxiety disorders, continuing anxiety disorders (both childhood and then adulthood anxiety disorder in the parent), social phobia, and childhood avoidant and overanxious disorders (Table 1) as compared with first degree relatives of children from a nonclinical comparison group.

Maternally expressed emotion is another factor that has been studied in an attempt to understand the role played by BI in the development of anxiety disorders. Hirshfeld et al (17) reported that mothers with panic disorder expressed significantly more criticism toward BI children than uninhibited children. In mothers with panic disorder, the rate of criticism in inhibited children was 13 of 20 (65.0%) versus two of 11 (18.2%) in uninhibited children. This tendency toward criticism was not found in nonanxious mothers. They suggested that anxiety in the mother and the presence of difficult behaviour in her child may contribute to a strained mother-child relationship and may exacerbate symptoms for both. This model ironically supports a notion first expressed by Thomas and Chess (18), who in some ways, were the first to challenge the notion of children born as blank slates. Thomas and Chess suggested that some children were harder to parent from birth, and that bad parental fit was a very important factor in the development of psychopathology. Further support for this notion came from Nachimas et al (19), who examined the effect of the mother-toddler attachment relationship as it relates to the moderation of the BI and salivary cortisol relationship in response to novel situations. The study involved 77 18-month-old toddlers. Elevations in salivary cortisol only occurred in toddlers who were in insecure attachment relationships, further suggesting that BI interacts with the development of an anxiety disorder partly through parent-child connections.

Mick et al (20) attempted to further investigate the specific relationship between adult anxiety disorders and childhood BI through an analysis of retrospective reports of childhood BI among undergraduates reporting one of the following: generalized anxiety, social anxiety, both generalized and social anxiety, and minimal social and generalized anxiety. Childhood BI was reported using Retrospective Self-Report of Behavioural Inhibition (RSRI) scores (21). The RSRI evaluation included questions to evaluate social fears and general fearfulness. The mean RSRI score for controls was 1.89. Their findings showed that a history of childhood BI was associated with symptoms of social phobia (mean RSRI=2.57), but not generalized anxiety disorder (mean RSRI=1.99). Also, participants who showed symptoms of both generalized anxiety disorder and social phobia (RSRI=2.67) were no more likely to report a childhood history of BI than those with social phobia alone. Nevertheless, the self-report inherent to this methodology left the specificity for the development of social phobia versus generalized anxiety disorder somewhat in question.

However, the role of BI specifically in the development of social phobia was supported by Hayward et al (22). In a four-year prospective study of high school students, Hayward et al found that 22.3% of subjects with social avoidance and fearfulness developed social phobia, a risk more than four times greater than that for subjects without either feature of BI. Van Ameringen et al (23) further bolstered this viewpoint when they examined the role of social and nonsocial inhibition in predicting anxiety disorder symptomatology. In their study, patients were asked to complete the RSRI (21) and Revised Shyness Scale (24). They found that social rather than nonsocial fearfulness accounted for the relationship between BI and the symptomatic presentation of the anxiety disorders, further supporting the notion of the relationship between BI and social phobia. This link of BI to social phobia was further supported by Schwartz et al (9), who found that adolescents classified as meeting criteria for BI at two years of age (who tended to have a preservation of BI into early adolescence) were more likely to be suffering from social anxiety at age 13 years. That is, 61% of these subjects classified as BI at 21 months of age had current social anxiety, versus 27% of the uninhibited subjects. When the threshold was raised to include impairment in functioning, 44% of female adolescents who were inhibited at age 21 months were impaired by social anxiety versus only 6% in those who had been uninhibited. In males, the results were not significant.

CONCLUSIONS

There exists evidence of an association between BI and anxiety disorders. BI may be an early identifiable risk factor

for the development of anxiety disorders in childhood or adulthood, and therefore, could help identify children who would benefit from interventions (perhaps as a preventive treatment). The use of a few simple screening questions, combined with specific observations during routine visits to a primary care physician or paediatrician, might be particularly useful in detecting the presence of BI, and therefore, patients who are at increased risk of developing anxiety disorders. Obviously, this screening process would be even more useful in high-risk children (for example, those with a family history of anxiety disorders).

Furthermore, once risk factors for the development of an anxiety disorder are identified in a specific child, steps can be taken to educate parents to look for signs of a disorder and perhaps initiate behavioural strategies that could potentially lower the risk for developing anxiety disorders in general, and social phobia in particular. A number of parenting methods have been suggested (25), including specific interventions to manage avoidance by systematically exposing the child in a graduated fashion to feared situations, in combination with reassurance, soothing and cognitive tools such as anticipatory explanation and realistic appraisals. Evidence in support of parenting styles that reduce behavioural inhibition (and therefore the risk of developing an anxiety disorder) can be seen from the noted change in some children from an inhibited to an uninhibited temperament stance (8).

Ultimately, larger longitudinal studies would be useful in understanding the course of BI and the factors that modify the risk of developing anxiety disorders.

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