Posttraumatic stress disorders in children and adolescents

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Millions of children are exposed to traumatic experiences each year. Over 30% of these children develop a clinical syndrome with emotional, behavioral, cognitive, social, and physical symptoms called posttraumatic stress disorder. The symptoms of posttraumatic stress disorder fall into three clusters: reenactment of the traumatic event: avoidance of cues associated with the event or general withdrawal; and physiological hyperreactivity. Significant physical and medical problems in childhood, adolescence, and adulthood appear to be related to childhood trauma. Current treatment approaches include postacute psychoeducation, individual psychotherapy, pharmacotherapy, and cognitive-behavioral therapy. Despite increasing attention over the past 10 years, childhood posttraumatic stress disorder remains an understudied public health problem. Curr Opin Pediatr 1999, 11:310–316 © 1999 Lippincott Williams & Wilkins, Inc.

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Abbreviations

DSM IV	*Diagnostic and Statistical Manual of Mental Disorders*, fourth edition
PTSD	posttraumatic stress disorder
PTSS	posttraumatic signs or symptoms

Neurophysiological core of posttraumatic stress disorder

Each year in the United States more than five million children are exposed to some form of extreme traumatic stressor. These traumatic events include natural disasters (eg, tornadoes, floods, hurricanes), motor vehicle accidents, life-threatening illnesses and associated painful medical procedures (eg, severe burns, cancer), physical abuse, sexual assault, witnessing domestic or community violence, kidnapping, and sudden death of a parent, among others [1,2••]. These events, posing an actual or perceived threat to the individual, activate a stress response. During the traumatic event, the child's brain orchestrates adaptive stress-mediating neural systems including the hypothalamic-pituitary-adrenal axis, central nervous system noradrenergic, and dopaminergic systems and associated central and peripheral nervous system mechanisms that provide the adaptive emotional, behavioral, cognitive, and physiological changes necessary for survival [3•].

Individual adaptive responses during traumatic stress are heterogeneous [4,5]. The specific nature of a child's responses to a given traumatic event may vary with the nature, duration, and pattern of traumatic stressor and the child's constitutional characteristics (eg, genetic predisposition, age, gender, history of stress exposure, presence of attenuating factors such as supportive caregivers). Whatever the individual response, however, the extreme nature of the external threat is often matched by an extreme and persisting internal activation of the neurophysiological systems mediating the stress response and their associated functions [3•]. A primary adaptive feature of the threat-response system is single-trial "learning"—the capacity to generalize from a threatening event to other experiences with similar features. Unfortunately, this very adaptive capacity is at the core of the emotional, behavioral, and physiological symptoms that develop following a traumatic experience.

Neural systems respond to prolonged, repetitive activation by altering their neurochemical and, sometimes, microarchitectural (eg, synaptic sculpting) organization and functioning. This is no different for the neural systems mediating the stress response. Following any traumatic event, children will likely experience some persisting emotional, behavioral, cognitive, and physiological signs and symptoms related to the sometimes

temporary shifts in their internal physiological homeostasis. In general, the longer the activation of the stress-response systems (*ie*, the more intense and prolonged the traumatic event), the more likely there will be a "use-dependent" change in these neural systems [3•,4,6]. In some cases, then, the stress-response systems do not return to the pre-event homeostasis. In these cases, the signs and symptoms become so severe, persisting, and disruptive that they reach the level of a clinical disorder [5]. In a new context and in the absence of any true external threat, the abnormal persistence of a once-adaptive response becomes maladaptive.

Posttraumatic stress–related clinical syndromes

Posttraumatic stress disorder (PTSD) is a clinical syndrome that may develop following extreme traumatic stress *Diagnostic and Statistical Manual of Mental Disorders [DSM IV]* [7]. Like all other *DSM IV* diagnoses, it is likely that heterogeneous pathophysiologies underlie the cluster of diagnostic signs and symptoms labeled PTSD. With this in mind, there are six diagnostic criteria for PTSD: extreme traumatic stress accompanied by intense fear, horror, or disorganized behavior; persistent reexperiencing of the traumatic event such as repetitive play or recurring intrusive thoughts; avoidance of cues associated with the trauma or emotional numbing; persistent physiological hyperreactivity or arousal; signs and symptoms present for more than 1 month following the traumatic event; and clinically significant disturbance in functioning. A child is considered to have acute stress disorder (*DSM IV*) when these criteria are met during the month following a traumatic event. PTSD is further characterized as acute when present for less than 3 months, chronic when present for more than 3 months, or delayed onset when symptoms develop initially 6 months or more after the trauma.

Posttraumatic stress disorder has been studied primarily in adult populations, most commonly, combat veterans and victims of sexual assault. Despite high numbers of traumatized children, the clinical phenomenology, treatment, and neurophysiological correlates of childhood PTSD remain understudied. The clinical phenomenology of trauma-related neuropsychiatric sequelae are poorly characterized [8,9]. Most of the studies of PTSD have been following single discrete traumas (*eg*, a shooting). The least-characterized populations are very young children and children who have undergone multiple or chronic traumatic events.

Several factors complicate the study of PTSD in children. It has only been in the past 10 years that child-specific, structured interviews for PTSD have become available. The development of trauma-specific psycho-metrics continues [10,11]. In very young children, diagnostic assessment is difficult due to the inability of infants and toddlers to self-report trauma-related symptoms, the differential expression of symptoms across the developmental spectrum, and the difficulty determining the nature and extent of certain traumatic experiences (*eg*, exposure to domestic violence or physical abuse) [12,13]. A key complication in studying and treating trauma-related neuropsychiatric problems in children is the complex and varied clinical presentations that may result following acute or chronic trauma [8].

Clinical presentation

Children with PTSD may present with a combination of problems including impulsivity, distractibility, and attention problems (due to hypervigilance), dysphoria, emotional numbing, social avoidance, dissociation, sleep problems, aggressive (often reenactment) play, school failure, and regressed or delayed development. In most studies examining the development of PTSD following a given traumatic experience, twice as many children suffer from significant posttraumatic signs or symptoms (PTSSs) as are diagnosed with PTSD; however, children diagnosed as having PTSSs lack all of the criteria necessary for the diagnosis of PTSD [14]. In these cases, the clinician may identify the trauma-related symptom as being part of another neuropsychiatric syndrome.

The clinician is often unaware of ongoing traumatic stressors (*eg*, domestic or community violence), or the family makes no association between the present symptoms and past events (*eg*, car accident, death of a relative, exposure to violence) and may provide no relevant history that would aid the clinician in the differential diagnosis. As a result, PTSD is frequently misdiagnosed, and PTSSs are underrecognized. Children with PTSD as a primary diagnosis are often labeled with attention deficit disorder with hyperactivity, major depression, oppositional defiant disorder, conduct disorder, separation anxiety, or a specific phobia. Ackerman *et al.* [15•] examined the prevalence of PTSD and other neuropsychiatric disorders in 204 abused children (ages 7 to 13 years). Thirty-four percent of these children met criteria for PTSD. More than 50% of the children in this study who had suffered both physical and sexual abuse had PTSD. Using a structured diagnostic interview, the majority of these children met diagnostic criteria for three or more DSM IV Axis I diagnoses in addition to PTSD. Indeed, only six of 204 children met criteria for only PTSD. The broad comorbidity reported in this study echoes previous studies.

Diagnostic criteria from the *DSM IV* yield multiple labels in maltreated children, but these diagnoses rarely provide useful information about etiology, course, treat-

ment response, or prognosis. At present, despite an evolving clinical phenomenology, it is clear that PTSD is not the only, nor an inevitable, outcome of traumatic events during childhood. Posttraumatic hyperarousal or dissociative-like symptoms often coexist with these other axis I disorders. Furthermore, severe early trauma appears to be an expresser of underlying constitutional or genetic vulnerability and may be a primary etiologic factor in the development of a broad range of disorders later in life.

Incidence and prevalence

Estimates of lifetime incidence of PTSD range from 3% to 14% [7]. Cuffe *et al.* [16•] examined population prevalence of PTSD in a community sample of adolescents. They found that 3% of girls and 1% of boys met the *DSM IV* criteria for PTSD. In this study, girls reported more traumatic events than boys. Being female, experiencing rape or sexual abuse, and witnessing an accident or medical emergency were associated with increased risk for PTSD. Children exposed to various traumatic events have much higher incidence (from > 15% to > 90%) and prevalence rates than the general population [1]. Several studies published in 1998 confirm previous reports of high prevalence rates for PTSD in high-risk groups. Thirty-five percent of a sample of adolescents in whom cancer was diagnosed met criteria for lifetime PTSD [17•]; 15% of children surviving cancer had moderate to severe PTSS [18]; 93% of a sample of children witnessing domestic violence had PTSD [19]; over 80% of the Kuwaiti children exposed to the violence of the Gulf Crisis had PTSS [20]; 73% of juvenile male rape victims develop PTSD [21]; 34% of a sample of children experiencing sexual or physical abuse and 58% of children experiencing both physical and sexual abuse all met criteria for PTSD [15•]. In all of these studies, clinically significant symptoms, though not full PTSD, were observed in essentially all of the children or adolescents following the traumatic experiences.

Vulnerability and resilience

Not all children exposed to traumatic events develop PTSD. A major research focus has been identifying factors (mediating factors) that are associated with increased risk (vulnerability) or decreased risk (resilience) for developing PTSD following exposure to traumatic stress [19]. Factors previously demonstrated to be related to risk can be summarized in these broad categories: characteristics of the child (*eg*, subjective perception of threat to life or limb, history of traumatic exposures, coping style, general level of anxiety, gender, age); characteristics of the event (*eg*, nature of the event, direct physical harm, proximity to threat, pattern and duration); characteristics of the

child's family or social system (*eg*, supportive, calm, nurturing versus chaotic, distant, absent, anxious) [18,22,23]. Each of these mediating factors can be related to the degree to which they either prolong or attenuate the child's stress-response activation resulting from the traumatic experience. Factors that increase stress-related reactivity (*eg*, family chaos) will make children more vulnerable, whereas factors that provide structure, predictability, nurturing, and sense of safety will decrease vulnerability. Persistently activated stress-response neurophysiology in the dependent, fearful child will predispose to "use-dependent" changes in the neural systems mediating the stress response, thereby resulting in posttraumatic stress symptoms.

Adolescents with cancer who developed PTSD rated their families as more chaotic than adolescents with cancer who did not develop PTSD [17•]. Most interesting in this study, however, was that 85% of mothers of the PTSD group also developed PTSD related to their child's cancer. If the family is chaotic and the primary caregiver is traumatized by an event, their capacity to provide a consistent, predictable, and nurturing environment is compromised.

There are apparent gender differences in the expression and development of PTSD. Clinical experience and recent studies suggest that girls tend to exhibit more internalizing (*ie*, anxiety, dysphoria, dissociation, avoidance) and boys more externalizing (*ie*, impulsivity, aggression, inattention, hyperactivity) posttraumatic symptoms [4,15•]. In epidemiologic studies of PTSD in the general adult population, women have higher rates than men [24]. Although the extensive epidemiologic data from these adult studies are lacking in studies of children, a gender difference has been observed in several studies with children and adolescents [15•]. There appear to be gender differences in adaptive response in the acute event (girls dissociate more than boys) that may be related to this observed difference in development and expression of trauma-related symptoms [4].

Long-term consequences of childhood trauma

Posttraumatic stress disorder is a chronic disorder. Untreated, PTSS and PTSD remit at a very low rate. Indeed, the residual emotional, behavioral, cognitive, and social sequelae of childhood trauma persist and appear to contribute to a host of neuropsychiatric problems throughout life [25••], including attachment problems [26,27], eating disorders [28], depression [23,25••], suicidal behavior [29], anxiety [25••], alcoholism [25••,30], violent behavior [25••,31], mood disorders [32] and, of course, PTSD [33,34].

Childhood trauma affects other aspects of physical health throughout life as well [35•,36]. Adults victimized by sexual abuse in childhood are more likely to have difficulty in childbirth [37], a variety of gastrointestinal and gynecologic disorders, and other somatic problems such as chronic pain, headaches, and fatigue [37]. The Adverse Childhood Experiences study [38••] examined exposure to seven categories of adverse events during childhood (*eg*, sexual abuse, physical abuse, witnessing domestic violence: events associated with increased risk for PTSD). This study found a graded relationship between the number of adverse events in childhood and the adult health and disease outcomes examined (*eg*, heart disease, cancer, chronic lung disease, and various risk behaviors). With four or more adverse childhood events, the risk for various medical conditions increased four- to 12-fold.

Special concerns for pediatrics

Pediatricians should be aware that children with PTSD or PTSS may have altered sensitivity and functioning of neuroendocrine and autonomic nervous systems [6,35•,39–41]. This altered sensitivity may predispose to the development of various medical conditions such as asthma, hypertension, cardiac arrhythmias, endocrine disorders, gastrointestinal disorders, and various other somatic complaints [36]. Furthermore, PTSD complicates the treatment of various medical conditions [42]. In children with diabetes, for example, the PTSD-related hyperreactivity of the counterregulatory hormones such as adrenaline may complicate or prevent effective control of blood sugar. History of sexual or physical abuse can complicate the medical examination of traumatized children, manifesting as resistance to medical examination and procedures [43,44]. In a variation of PTSS adaptation, excessive compliance, "numbing," and insensitivity to pain may also be seen in children with histories of chronic exposure to traumatic violence in the home. Addressing posttraumatic stress symptoms within a multidisciplinary approach is an important component of improved outcomes following childhood injuries [45].

Treatment approach

To date, few treatment outcome studies in children with PTSS and PTSD have been published. Despite this dearth of objective data, a wealth of papers on clinical experience and subjective treatment approaches have been published [1]. The nature of these reported clinical approaches depends on the theoretical perspective of the author. At present, the mechanism-based conceptual frameworks explaining the development of PTSD fall into four main categories: 1) psychoanalytic, 2) cognitive-behavioral, 3) psychodevelopmental, and 4) neurodevelopmental. Each of these offers certain insights but none provides a complete and unambiguous

treatment approach. Therefore, the treatment of children with PTSD varies greatly depending on the specific clinician's training, perspective, and experience. Typically, the nature and severity of specific symptoms (*eg*, impulsivity, withdrawal, hypervigilance, dissociation, dysphoria, and aggression) dictate treatment approach rather than the diagnosis. Another major consideration in treatment is distinguishing between a single discrete traumatic event (*eg*, car accident or witnessing an assault) and chronic or pervasive trauma (*eg*, chronic abuse). Symptoms following a single event (*eg*, motor vehicle accident) tend to be fewer and less treatment resistant compared with the more complex symptom clusters associated with chronic or pervasive traumatic stress (*eg*, a combination of physical and sexual abuse). A host of clinical treatments are used with traumatized children, including family therapy, group therapy, eye-movement desensitization and reprogramming (EMDR), music and movement therapies, "play" therapy, and art therapy, among many others. Four of the major therapeutic approaches used alone or in combination are discussed here.

Secondary prevention using acute posttraumatic interventions

In the immediate posttraumatic period, several models of intervention have been used to diminish the acute distress and improve posttraumatic outcome [46]. One of the most important is psychoeducation. Telling the family and child what the expected signs and symptoms are following a traumatic event can help diminish anxiety, increase sense of competence, and provide a baseline from which parents and children can be aware of abnormally intense or prolonged symptoms requiring further clinical attention. Several modifications of a critical incident stress-debriefing paradigm have been reported, though efficacy has not yet been determined. In some cases, clinicians have used antianxiety agents or clonidine to decrease the level of physiological hyper-arousal and distress in the acute posttraumatic period [47]. Although these postacute interventions are clinically helpful during this period, it is not yet clear that any of them alter the development, course, or severity of PTSD.

Pharmacotherapy

There have been very few published trials of psychotropic medications in childhood PTSD [1,5]. Without the benefit of clinical outcome studies, the selection of psychotropic agents has been guided by empirical clinical judgment and the clinical observations that primary symptoms in PTSD appear to respond to psychotropic agents proven to be useful for those symptoms in other neuropsychiatric disorders (*eg*, valproic acid and lithium for aggressive behavior, fluoxetine for depressive symptoms).

Many of the symptoms of PTSD can be traced to the core symptoms of physiological hyperarousal such as sleep problems (including difficulties falling asleep, early night awakening, nightmares, night terrors), generalized anxiety, behavioral impulsivity, or hyperreactivity of the sympathetic nervous system including tachycardia, hypertension, increased muscle tone, respiratory problems, and body temperature dysregulation. Clonidine, an α_2-adrenergic partial agonist that modulates the reactivity of the locus caeruleus and decreases the physiological hyperreactivity associated with PTSD, has been shown to be an effective agent in children with PTSD [6]. Other agents altering the biogenic amines (*ie,* serotonin, dopamine, and norepinephrine) may also modulate the symptoms of PTSD. In this regard, preliminary reports support the efficacy of propranolol and fluoxetine in children with anxiety and PTSD [5].

Individual psychotherapy

The core hyperarousal symptoms result in a cascade of secondary, interrelated problems. Inability to engage in appropriate intimacy leads to difficulties with peer and adult relationships, and inability to perform adequately in school leads to poor self-esteem, resulting in a variety of learned behaviors that both mask and defend against these core deficits driven by their physiological hyperreactivity. The resulting vicious cycle of poor performance, poor self-esteem, and development of maladaptive problem-solving styles, in turn, is difficult to treat as long as the underlying physiological hyperreactivity impairs the ability to modulate anxiety, concentrate on academic or social learning tasks, and contain behavioral impulsivity. Successful treatment, therefore, often requires "containing" or modifying this core physiological dysregulation with medications and using other psychotherapeutic interventions to address issues related to self-esteem, competence, social skills, and mastery of specific fears.

Cognitive-behavioral therapies

Cognitive-behavioral therapy is the most studied and likely the most effective therapeutic intervention in adults with single-event-related PTSD. The few studies of cognitive-behavioral therapy in children and adolescents are very promising [48]. March *et al.* [49••] examined a standard cognitive-behavioral therapy protocol in school-aged children following a single traumatic event. After the course of treatment, significant improvement was noted in all main dependent measures. Unfortunately, cognitive-behavioral therapy is difficult to apply in the same fashion to very young children or to children with chronic pervasive trauma.

Conclusions and future directions

Despite the progress of the past few years, childhood PTSD remains a woefully understudied disorder.

Conservative estimates of the frequency of traumatic events (> five million children traumatized per year) and the well-documented incidence rates of more than 30% following a trauma suggest that there may be as many as 1.5 million children developing PTSD each year. Further, based on the documented incidence from high-risk populations, another 1.5 million may have clinically significant posttraumatic stress symptoms that do not meet full PTSD criteria. PTSD and PTSS are chronic problems. Available data show only moderate rates of remitted symptoms over time; in contrast, adolescents and adults who have undergone childhood trauma appear to be more vulnerable to a host of medical and neuropsychiatric problems. Better characterized clinical phenomenology, outcome studies examining a variety of therapeutic modalities, and mechanism-focused neurophysiological studies are necessary to better characterize PTSD and the other sequelae of childhood trauma.

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