

Pediatric Accidental Trauma: Screening and Reducing Psychological Impact

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The recognition that children can develop post-traumatic stress disorder (PTSD) following traumatic events was not made until the third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (Carrion & Kletter, 2012). Although the vast majority of accidentally injured children experience full post-injury physical recovery, a significant subset experiences negative psychological sequelae, including PTSD, depression, and other anxiety disorders (Kassam-Adams et al., 2013). PTSD is the most common psychiatric disorder following traumatic events (Caffo & Belaise, 2003). Symptoms of PTSD can lead to lower health-related quality of life for up to 2 years following injury (Kassam-Adams et al., 2015). Although increased rates of psychological issues post-trauma are accepted in medical literature, the number of children identified and referred to appropriate services for treatment is consistently low. This leads to long-term negative effects that have an impact on children physically, emotionally, cognitively, and developmentally.

Background

In the United States, an estimated 9.2 million children annually have an emergency department visit for an

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This article explores long-term psychological effects of accidental trauma on pediatric patients and implications for nursing care. A connection between pediatric accidental trauma and long-term psychological sequela is well documented in medical literature. Despite this known connection, low screening rates and psychological referrals continue. Instead, an emphasis is placed on physical recovery. As a result, pediatric patients have full physical recovery but have remaining psychological sequelae that are not addressed. Sequelae often manifests as post-traumatic stress disorder (PTSD), depression, and anxiety disorders, which often results in poor behavior and coping patterns, learning difficulties, and alterations in brain development. Nurses are integral members of the team responsible for providing care for pediatric trauma patients. Nursing implications include the use of trauma-informed care and appropriate screening techniques. Nurses can identify and provide early intervention to prevent long-term sequela of psychological distress in pediatric patients with accidental trauma.

Key Words:

Pediatric trauma, post-traumatic stress disorder, PTSD, trauma-informed care, screening.

unintentional injury (Centers for Disease Control and Prevention [CDC], 2008). The majority of nonfatal injuries are caused by being struck by or against an object, falls, burns, poisonings, animal bites, and motor vehicle crashes (CDC, 2019) (see Table 1). Trauma is defined as an experience that involves actual or perceived threat of death or serious injury of self or others combined with intense feelings of fear, helplessness, or horror (Carrion & Kletter, 2012). Although millions of children are exposed to some form of traumatic stressor each year, the majority of injured children do not receive mental health care (Caffo & Belaise, 2003). Research consistently demonstrates that objective injury severity does not predict the development of PTSD, but instead, the child's subjective sense of life threat

takes precedence in PTSD symptom development (Kassam-Adams et al., 2013). Even seemingly low traumatic injuries, such as athletes with anterior cruciate ligament rupture, have shown a high prevalence of PTSD symptoms following diagnosis (Padaki et al., 2018).

Pathophysiology

The pathophysiology behind PTSD is not completely understood. Neuroendocrine literature theorizes dysregulation of the hypothalamic pituitary adrenal (HPA) axis causes lower serum levels of cortisol in individuals diagnosed with PTSD (Pervanidou, 2008). Immediately following the initial traumatic event there is an elevation of cortisol and catecholamines circulating systemical-

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Table 1.
Leading Causes of Nonfatal Injury in the United States 2010-2017 Grouped by Age

Age in years	<1	1-4	5-9	10-14	15-24
Fall	55.3%	43.1%	36.6%	25.8%	14.1%
Struck by/Against	10.8%	15.7%	22.4%	25.8%	15.8%
Bite/Sting	6.2%	8.6%	7.4%	3.3%	3.1%
Cut/pierce	1.8%	3.7%	6.1%	5.7%	7.3%
Overexertion		3.6%	4.5%	12.7%	10.3%
Poisoning	1.6%	2.3%			5.2%
Foreign body	4.0%	7.5%	3.6%		
MV – Occupant			3.7%	3.7%	12.5%
Fire/Burn	2.5%	2.5%			
Pedal Cyclist			2.7%	2.8%	
Assault struck by/Against				3.1%	6.5%
Dog bite			2.3%		
Inhalation/Suffocation	3.9%				
Others	13.9%	13.0%	6.2%	4.4%	14.9%
Total number of injuries	217,137	1,622,230	1,447,263	1,747,575	4,771,839

Source: Centers for Disease Control and Prevention (CDC), 2019.

ly. Over time, as the individual develops PTSD, dysregulation of the HPA axis results in cortisol levels decreasing while catecholamines levels increase (Pervanidou, 2008). Children who have endured trauma are also thought to have greater fluctuations in cortisol throughout the day due to alterations at the HPA axis (Pervanidou, 2008). Further, the amygdala, prefrontal cortex, and the hippocampus are particularly vulnerable to childhood trauma (Carrion & Kletter, 2012). These three regions of the brain are instrumental in the storage and retrieval of fearful memories (McCance & Huether, 2019).

Prefrontal Cortex

The prefrontal cortex is responsible for executive functioning, such as attention regulation, memory processing, and response inhibition. Traumatized youth with PTSD have decreased activation of their prefrontal cortex (Carrion et al., 2008; McCance & Huether, 2019). Youth with PTSD demonstrate a sustained reduction and abnormal neurodevelopment in key prefrontal nodes (Heyn et al., 2019). Over time, a decreased intrinsic connectivity between the prefrontal cortex and the amygdala and hippocam-

pus is observed (Heyn et al., 2019). This results in failure of the prefrontal cortex to control fear responses activated by the amygdala (McCance & Huether, 2019).

Amygdala

The amygdala is responsible for processing emotions and consolidates emotional memories. It plays an important part in accessing threatening stimuli. Individuals who experience trauma and develop PTSD demonstrate increased activity of the amygdala that leads to increased fear responses (McCance & Huether, 2019). Imaging studies, such as magnetic resonance imaging (MRI), have found no difference in amygdala size between children who have experienced trauma and those who have not. Instead, numerous studies have found when children predisposed by trauma are shown threatening pictures, they demonstrate hyperarousal of their amygdala compared to a control group without a trauma history (Carrion & Kletter, 2012).

Hippocampus

The hippocampus is responsible for consolidation of memories. During a memory retrieval task, youth

with PTSD showed reduced activation of the hippocampus (Carrion et al., 2010). Brain imaging has demonstrated reduced size of the hippocampus in individuals with PTSD (McCance & Huether, 2019). This results in decreased ability to remember key details surrounding the traumatic event and impacts the ability to store new memories.

Brain Plasticity

Experiences shape the extensive formation and organization of neural connections. Failure to form connections results in selective elimination or pruning of unused neurons. Children with prolonged PTSD can demonstrate overall decreased brain mass compared to children without PTSD (McCance & Huether, 2019). As discussed, PTSD leads to alterations in brain function and development. The pediatric brain has the ability to regenerate these connections and reverse the negative effects of trauma on the brain. The brain is most malleable during childhood, thus early intervention is critical. The use of evidence-based psychotherapy to treat trauma symptoms may improve brain function by promoting cortical neurogenesis (Carrion & Kletter, 2012).

Manifestations of PTSD

Not every child who experiences trauma will develop PTSD. The individual's characteristics, such as gender, age, developmental level, and psychiatric history, contribute to the development of PTSD (Caffo & Belaise, 2003). Risk of development also depends on level of acute pain, emotional distress, separation from parents, poor social support, child coping strategies, and parental emotional distress (Kassam-Adams et al., 2013). There are four trajectories of PTSD symptom development following an injury: resilient, recovery, chronic, or delayed onset (De Young et al., 2012). Most children will follow the resilient trajectory, with a smaller proportion following the chronic or delayed trajectories and continuing to experience symptoms for months to years (De Young et al., 2012).

PTSD symptoms are separated into the following four groupings by the *Diagnostic and Statistical Manual of Mental Disorders V*: reexperiencing, avoidance, negative cognition and mood, and hyperarousal (McCance & Huether, 2019). A child can demonstrate any number of symptoms with more severe cases presenting with all four. Symptoms must be present for one month and cause significant distress or impairment of functioning before a diagnosis of PTSD can be made (Carrion & Kletter, 2012).

Reexperiencing the Trauma

Reexperiencing the trauma includes flashbacks, nightmares, exaggerated startle response, and intrusive memories (Carrion & Kletter, 2012). Reexperiencing can occur at any time throughout the day or night, but is typically triggered by circumstances seemingly benign to a layperson. This drastically impacts the child's ability to complete activities of everyday living.

Avoidance of Trauma

Avoidance of distressing memories and external reminders of trauma are common with PTSD (McCance & Huether, 2019). Individuals with PTSD can develop fears of certain places and situations, resulting in withdrawal and avoidance (Carrion & Kletter, 2012). A will to avoid trauma results in changes in attitudes about self, others, and the future. Furthermore, avoidance can lead to poor coping skills, such as denial,

learned helplessness, and poor regulation of emotions in stressful situations (Carrion & Kletter, 2012).

Negative Cognition and Mood

Negative cognition and mood results from persistent and distorted sense of blame of self or others, resulting in withdrawal from others and diminished interest in activities (McCance & Huether, 2019). Negative cognition and mood present with symptoms of numbness and distractibility. Often children will experience less pleasure from activities they previously enjoyed. Children may have difficulty maintaining peer and family relationships (Carrion & Kletter, 2012). Negative cognition or mood results in high rates of depression in children with PTSD.

Hyperarousal

Hyperarousal is due to an elevated fight or flight response. This often results in aggressive, reckless, or self-destructive behaviors (McCance & Huether, 2019). Children with hyperarousal demonstrate increased irritability, hypervigilance, and difficulties with sleeping and concentration (Carrion & Kletter, 2012). Difficulties in concentration can significantly alter a child's academic performance. Children can demonstrate memory difficulties that affect learning new material and remembering previously acquired skills (Carrion & Kletter, 2012).

Implications for Nursing Practice

Trauma Informed Care

Trauma-informed care incorporates an understanding of trauma and PTSD in each clinical encounter with traumatically injured children and their families. Trauma-informed care contains many of the same aspects as patient-centered care, but it differs by incorporating practices to reduce the impact of potentially traumatic medical events to reduce the risk of perpetuating PTSD symptoms (Kassam-Adams et al., 2015). Providing emotional support for the child and family, along with screening to determine which children and families need additional support, are integral elements of trauma-informed care. An emphasis is placed on immediately addressing the child's distress, such as pain and fear, with a goal to provide

anticipatory guidance to assist children with adaptive coping strategies. Furthermore, identifying family strengths and routinely providing the family with pertinent information is also important in trauma-informed care (Kassam-Adams et al., 2015). The primary goal should be to minimize emotional distress associated with pediatric injury and illness. Medical teams that implement trauma-informed pediatric care acknowledge the preexisting trauma, and furthermore, understand medical care itself can be seen as traumatic (Price et al., 2018).

Literature highlights the use of therapeutic play with the implementation of trauma-informed care practices. Play is a critical childhood developmental tool and assists the child with processing, understanding, and communicating their emotions and thoughts (Stenman et al., 2019). Play can be used to deescalate possible traumatic experiences, such as pain, physical changes, fear, uncertainty, and changes in family functioning. Furthermore, play fosters positive provider-patient relationships, restores normalcy, and relieves boredom (Stenman et al., 2019). Integrating play with trauma-informed care enables the provider to distract and reduce anxiety while also delivering information in a language the child understands. The child is able to use play to process emotions and foster control over their surroundings and situation.

Pediatric health care providers can implement trauma informed care by using the DEF protocol. DEF stands for reducing distress, emotional support, and including the family in care (Marsac et al., 2016). DEF protocol is an evidence-based method for health care professionals to integrate trauma-informed care into practice. This protocol is implemented after the basic health care needs of airway, breathing, circulation (ABC) have been addressed. Therefore, this results in an ABCDEF process of caring for pediatric patients. Along with the implementation of the DEF protocol, health care professionals should also integrate standardized screening tools into their practice to identify pediatric patients in need of referrals for additional support. Standardized screening for risk of post-traumatic symptoms is an essential part of trauma-informed care (Price et al., 2018).

Screenings

Screening for psychological distress following traumatic injuries is of utmost importance. Screening allows the child to receive referrals and psychological care to decrease long-term effects of PTSD. Numerous instruments are available for screening for traumatic events and diagnosing childhood PTSD. A recent national survey of multiple Level 1 trauma centers found only 20% of pediatric and adult patients were routinely screened for PTSD symptoms following injuries (Zatzick et al., 2011). Initial hospitalization presents a unique opportunity for completing screening because psychological services are often available in the hospital setting. Early intervention with psychosocial services allows for preventive intervention and watchful waiting for emotional recovery following injury (Price et al., 2018). Most children will require specialist or primary care follow-up post-discharge, which makes the outpatient setting another crucial intersect for implementation of screening.

Standardized screening processes are important for hospital systems to implement. Standardized screenings in pediatric settings correlate to improved recognition and referrals of children and families to psychosocial services. The rate of pediatric patients who received psychological consults during admission was significantly higher in hospital systems with standardized screening processes (Price et al., 2018). Standardized screenings built into discharge and follow-up processes have decreased stigma of psychological interventions and increased coordination of the patient's needs following discharge (Cline et al., 2018). Identified barriers of implementation of standardized screening processes are limited personnel time, and mental health resources for follow-up; determining responsible party for administration; choosing a method of screening; and brief admissions (Price et al., 2018). It is important to combat these barriers to enable standardized screening to be implemented. Moreover, it is imperative children are identified early and receive timely intervention to prevent long-term sequelae of PTSD.

Discussion

Data are consistent that there is a significant connection between phys-

ical trauma of a pediatric patient and long-term psychological effects, such as PTSD, depression, and anxiety disorders. Although this is a well-understood phenomenon in medical literature, there remains a disconnect in providing psychological care to pediatric trauma patients while admitted and through follow-up appointments. In follow-up appointments, there is often no screening for psychological distress, with an emphasis placed on physical recovery. As a result, pediatric patients may have full physical recovery from injuries, but have remaining unaddressed psychological trauma. Children with PTSD, depression, and anxiety disorders can demonstrate poor behavior and coping patterns, decreased learning, and alterations in brain development that can follow them into adolescence and adulthood.

Nurses are frontline care providers for children admitted for traumatic injuries. As such, nurses should be aware of the signs and symptoms of PTSD in children and familiar with the concepts of trauma-informed care. This allows nurses to care for children who have been exposed to a traumatic injury and reduce further traumatization in the hospital setting. An integral element of trauma-informed nursing care is appropriate screening and referral to services. Nurses should advocate for appropriate screening implementation in their hospital system. Standardized screening will reduce the number of children who are missed and go on to develop long-term sequelae from psychiatric conditions.

Conclusion

Even though PTSD in children has become widely accepted, the effects in children are not completely understood. There is a need for additional research to identify differences in manifestations between children and adults to better target interventions and treatments. The best method of research would be a randomized control trial to gain further understanding of the issue and develop best practices for prevention and treatment. Longitudinal studies to follow children into adulthood and qualitative studies to explore children's emotions surrounding their trauma and recovery would also be helpful to further understand PTSD in children after accidental trauma. As frontline

providers, nurses need to take an active step to decrease effects of trauma on children and reduce mental illness sequelae following accidental trauma.

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