Interventions for Attention Problems After Pediatric Traumatic Brain Injury: What Is the Evidence?

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Objective: To gain an understanding of the current state of the evidence for management of attention problems after traumatic brain injury (TBI) in children, determine gaps in the literature, and make recommendations for future research.
Type: Focused systematic review.
Literature Survey: PubMed/Medline and PsychINFO databases were searched for relevant articles published in English during the last 20 years. Keywords included "attention" "attention deficit and disruptive behavior disorders," and "brain injuries." Studies were limited to children.
Methodology: Titles were examined first and eliminated based on lack of relevancy to attention problems after brain injury in children. This was followed by an abstract and full text review. Article quality was determined based on the US Preventative Services Task Force recommendations for evidence grading.
Synthesis: Four pharmacologic and 10 cognitive therapy intervention studies were identified. These studies varied in level of evidence quality but were primarily nonrandomized or cohort studies.
Conclusions: There are studies that demonstrate benefits of varying pharmacologic and cognitive therapies for the management of attention problems after TBI. However, there is a paucity of evidence available to definitively guide management of attention problems after pediatric TBI. Larger randomized, controlled trials and multicenter studies are needed to elucidate optimal treatment strategies in this population.

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INTRODUCTION

Traumatic brain injury (TBI) is a leading cause of morbidity and mortality in children, leading to almost half a million emergency department visits, 35,000 hospitalizations, and more than 2000 deaths per year in the United States [1]. TBI results in numerous physical and cognitive sequelae. Cognitive deficits after TBI in children involve problems with attention, behavioral regulation, and executive function that worsen with increasing TBI severity [2-7]. Attention deficit hyperactivity disorder (ADHD) that develops after injury without evidence of preinjury ADHD is often referred to as secondary ADHD (S-ADHD). The prevalence of S-ADHD after TBI is estimated to be 14.5%-19% [8,9]. Developmental or primary ADHD (P-ADHD) has a greater prevalence in the TBI population at approximately 20% versus 4.5% in the general population [8]. S-ADHD is strongly associated with severity of TBI, and children with severe TBI have a greater risk for developing postinjury attention problems than those with mild or moderate TBI [10]. When combining these percentages, almost one-half of children who sustain a TBI will have persisting, worsening, or new attention problems after injury. The consequences of attention problems extend beyond school and learning and can have negative impacts on a child's social relationships, emotional well-being, and quality of life [11].

Because of the high prevalence of attention deficits in children after a TBI and their far-reaching negative effects, there is a critical need to optimize treatments to maximize recovery and function. To date, the majority of intervention studies that have evaluated attention problems after TBI are adult-focused [12-26]. Although the results of these studies are starting points for identifying therapies for children, adult and pediatric

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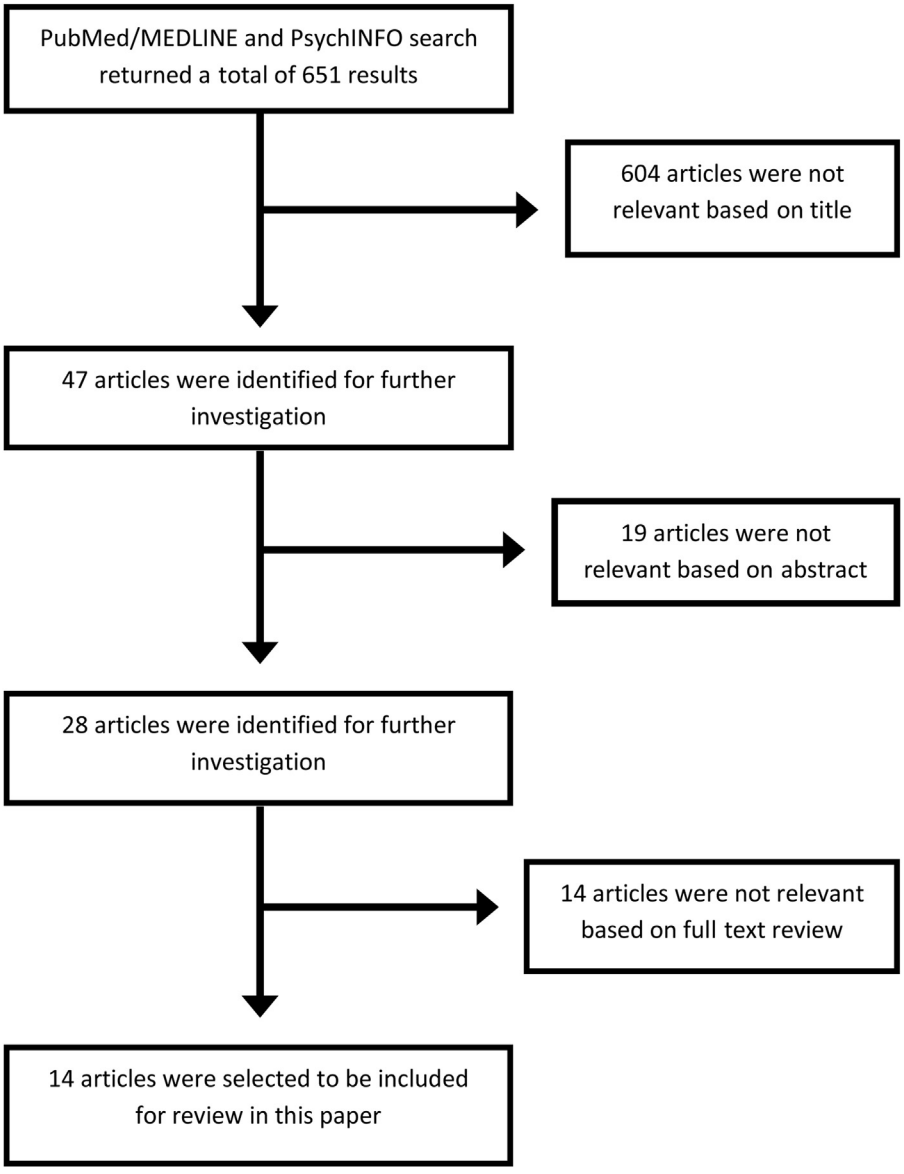

Figure 1. Methods of manuscript selection for review.

brains are very different. Children's brains rapidly develop throughout childhood and adolescence and have high degrees of plasticity compared with the brains of adults [27]. Differences between pediatric and adult brains likely are associated with differential recovery, and beneficial treatments may vary between the 2 groups.

The objective of this review is to describe the current literature specific to interventions, both pharmacologic- and behavioral-based, for attention problems in children after TBI. Previous review articles have primarily described studies in adults and have focused on pharmacologic interventions [13,14,17-22,25,26]. This article fills a critical gap by describing the state of the science of the current treatment options for attention problems after pediatric TBI. Because of the high prevalence of TBI in children and risk of developing new or worsening attention problems, it is imperative that evidence-based treatments are implemented to allow optimal management of attention problems in children after TBI. A discussion of the findings includes recommendations for current treatment based on the evidence and suggestions for future research.

METHODS

A literature search was conducted in the PubMed/MEDLINE and PsychINFO databases. Medical Subject Headings search terms were used in PubMed and altered for use in PsychINFO. The Medical Subject Headings search terms used