Case Series

Two Case Studies of Pediatric Traumatic Brain Injury: An Interdisciplinary Approach

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Abstract

Background: Physical and neurological deficits after a pediatric traumatic brain injury can result in significant functional limitations in all areas of daily living. A child's ability to generalize learning may be limited. Comprehensively assessing a client's skills through physical, occupational, and speech therapies may help to establish a baseline understanding about the importance of an interdisciplinary approach.

Methods: These two case studies describe the impact of interdisciplinary outpatient therapy services for two boys with traumatic brain injuries who received services before and after the pandemic.

Conclusion: The negative impact of the pandemic is demonstrated for both boys regarding functional progression and skill acquirement. However, the results after two years of aninterdisciplinary approach resulted in improvements in both clients'overall functioning. Additional studies are recommended to validate the findings.

Keywords: traumatic brain injury, interdisciplinary approach, outpatient therapy

Introduction

Traumatic brain injury (TBI) is defined by the Centers for Disease Control and Prevention[1] as an injury that impacts how the brain functions.While those 75 years and older had the highest numbers and rates of TBI-related hospitalizations and deaths, children had 16,070 TBI-related hospitalizations in 2019 and 2,774 TBI-related deaths in 2020[2]. Therapies can help children with TBI recover function, relearn skills, and practice new ways to engage that account for their new health status. Rehabilitation can include several different kinds of therapy for physical, emotional, and cognitive difficulties and for a variety of activities, such as daily self-care, driving, and interacting with others. Depending on the severity of the injury, therapy treatments may be needed only briefly, occasionally throughout a person's life, or on an ongoing basis[3].

Rehabilitative pediatric outpatient services can address a variety of performance skills in children with traumatic brain injuries.Occupational therapy can address activities of daily living and instrumental activities of daily living. Occupational therapists and assistants facilitate the development and refinement of fine motor coordination, visual perceptual, visual-motor integration, upper extremity strength, upper

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extremity coordination, and sensory processing skills that may have been impacted by the brain damage. Physical therapy can address motor skills. Physical therapists and assistants facilitate the development and refinement of gross motor skills, balance, coordination, strength, range of motion, and movement patterns that may have been affected by the trauma. Speech therapy may address communication and speech. Speech therapists and assistants facilitate the development and refinement of language social skills, communicating with others, speaking, listening, and utilization of voice altered by the insult on the brain.

Therapy services will often overlap regarding implementing techniques, strategies, and carryover but remain true to their scope of practice which is critical to the progression of clients with traumatic brain injuries.Therapy providers within the same field (e.g., occupational therapists and occupational therapy assistants) work towards the therapeutic goals established for each client. However, the therapist will evaluate and reassess the client, update goals, and eventually discharge the client when goals have been met.

Materials and Methods

Data were obtained from one pediatric outpatient clinic in the United States. Patient charts of Mike* and Bob* were reviewed with diagnosis of TBI confirmed. Therapy attendance, initial evaluation scores, and re-evaluation scores were recorded with relevant information (e.g., age and gender). Attendance was calculated by totaling the number of therapy sessions attended in between the initial evaluation and re-evaluation assessment sessions. Evaluation scores and re-evaluation scores were recorded for each respective discipline's assessment(s).

The Bruininks-Oseretsky Test of Motor Proficiency Second Edition (BOT-2) was utilized to assess Mike throughout his two years of physical therapy services. The BOT-2 covers fine and gross motor skills and provides six composite scores as well as one comprehensive measure of overall motor proficiency[4]. The Pediatric Balance Scale (PBS) is a modified version of Berg's Balance Scale was utilized to assess BOBThe PBSwas developed as a balance measure for school-age children with motor impairments[5].

Both Mike and Bob received physical therapy interventionssuch as therapeutic exercises.Through therapeutic exercises, physical therapists and assistants facilitated the development and refinement of gross motor skills, balance, coordination, strength, range of motion, and movement patterns. Development and refinement were the focus of the physical therapy interventions due to the deficits illustrated on the BOT-2 and PBS.

The Beery-Buktenica Developmental Test of Visual Motor Integration (Beery VMI) was utilized to assess Mike and Bobduring the course of their two years of occupational therapy services. The Beery VMI evaluates the extent to which individuals can integrate their visual and motor abilities[6].

Both Mike and Bob received occupational therapy interventions such as therapeutic activities.Through therapeutic activities, occupational therapists and assistants facilitated the development and refinement of fine motor coordination, visual perceptual, visual-motor integration, upper extremity strength, upper extremity coordination, and sensory processing skills. Development and refinement were the focus of the occupational therapy interventions due to the deficits illustrated on the Beery VMI.

The Clinical Evaluation of Language Fundamentals Fourth Edition(CELF-4) combines core subtests with supplementary subtests to get a comprehensive assessment of a student's language skills[7]. The Clinical Evaluation of Language Fundamentals Fifth Edition (CELF-5) provides therapists with a comprehensive battery to assess semantics, morphology, syntax, and pragmatics for children ages 5-21[8]. The CELF-4 and CELF-5 were utilized to assess Mike throughout his two years of speech language therapy services. Whereas the CELF-5 was utilized to assess Bobduring his two years of speech language therapy services.

Both Mike and Bob received speech language therapy interventions such as language activities. Through language activities, speech therapists and assistants facilitated the development and refinement of language social skills, communicating with others, speaking, listening, and utilization of voice. Development and refinement were the focus of the speech language therapy interventions due to the deficits illustrated on the CELF-4 and CELF-5.

Results and Discussion

These two case studies describe the impact of interdisciplinary outpatient therapy services for two boys with traumatic brain injuries who received services before and after the pandemic. Both Mike and Bobhad personal setbacks as well as enduring the pandemic. Mike had an increase in negative behaviors with poor frustration tolerance, which is noted during his second re-evaluation. Bob experienced a left distal tibial fracture in March 2021, which is noted during his second re-evaluation. Fluctuations in positive score increases are evident in both cases.

For physical therapy, Mike demonstrated a 9-point increase in bilateral coordination and 13-point increase in balance as measured by the BOT-2 after attending 31 physical therapy treatment sessions (an average of 1.3 sessions a month). For occupational therapy, Mike demonstrated a 0-point change in visual motor integration, 12-point increase in visual perceptual, and 0-point change in motor coordination as measured by the Beery VMI after attending 27 occupational therapy treatment sessions (an average of 1.1 sessions a month). For speech language therapy, Mike demonstrated an 8-point increase in word structure as measured by the CELF-4 and CELF-5 after attending 52 speech language therapy sessions (an average of 2.2sessions a month).

For physical therapy, Bob demonstrated an 8-point increase in balance as measured by the PBS after attending 84 treatment sessions (an average of 3.5 sessions a month). For occupational therapy, Bob demonstrated a 4-point increase in visual motor integration, 4-point increase in visual perceptual, and a 2-point decrease in motor coordination as measured by the Beery VMI after attending 103 occupational therapy treatment sessions (an average of 4.3 sessions a month). For speech language therapy, Bob demonstrated a 1-point decrease in formulated sentences and a 17-point increase in recalling sentences as measured by the CELF-5 after attending 31 speech language therapy sessions (an average of 1.3 sessions a month).

Two years of an interdisciplinary approach resulted in improvements in both clients' overall functioning. Mike did not demonstrate positive change in visual motor integration and motor coordination. Bob did not demonstrate positive change in motor coordination and formulated sentences. However, children with a history of TBI can present with cognitive problems years after the injury as developmental demands on the child increase[9].

Conclusion and Acknowledgment

Mike and Bob are two boys who experienced severe brain injuries and subsequently received outpatient therapy services at the same clinic where an interdisciplinary approach was utilized to ensure positive client outcomes. Therapists and assistants at the clinic Mike and Bob attended emulate an interdisciplinary team by meeting regularly to discuss and collaboratively set treatment goals for both boys[10].

Mike started outpatient therapy services including physical, occupational, and speech language therapies in 2019 when he was 7 years 8 months. His primary diagnosis was diffuse traumatic brain injury with loss of consciousness of unspecified duration. Unfortunately, in 2015 Mike accidentally inflicted a gunshot wound to himself, resulting in a TBI. Whereas Bob started outpatient therapy services including physical, occupational, and speech language therapies in 2020 when he was 12 years 3 months. His primary diagnosis traumatic brain injury with loss of consciousness of unspecified duration. Bob sustained a TBI in 2019 after being struck by a car. Mike and Bob both had subsequent complications after sustaining their TBIs including meningitis, developing cerebrospinal fluid leak, revision of cranioplasty, and insertion of lumbar drain.

After two years of receiving therapy services and enduring the impact of the pandemic on in person interventions, Mike and Bob both demonstrated improvements. The negative impact of the pandemic is demonstrated for both boys regarding functional progression and skill acquirement. However, the results after two years of an interdisciplinary approach resulted in improvements in both clients' overall functioning. Additional studies are recommended to validate the findings.

Ethical Clearance: This case report was intended for quality improvement for team building at the

outpatient clinic and did not need IRB approval. All families at the clinic sign a waiver, allowing data to be collected.

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