

**Critical Review:
In Adults with TBI and Dysphagia, do Cognitive Factors Influence Swallowing Outcomes?**

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This critical review examines evidence regarding the influence of cognitive factors on swallowing outcomes in the adult population with traumatic brain injury (TBI) and dysphagia. Study designs include case studies, a single-group investigation, and cohort studies. Overall, the evidence outlined here is suggestive. Recommendations for future research and clinical implications are discussed.

Introduction

Individuals with traumatic brain injury (TBI) often experience an array of challenges following the initial insult. Some of the most prominent difficulties relate to changes in cognitive function that affect aspects of communication and daily living. Cognitive factors that may be impacted in individuals with TBI include alterations in attention, impulse control, memory, reasoning, and organization and sequencing (Cherney & Halper, 1989). These often translate to cognitive communication challenges with both receptive and expressive language (Cherney & Halper, 1989; Halper et al., 1999). Furthermore, the brain of an adult past the age of twenty-five is fully mature, whereas the brain of a child is still growing and, thus, more susceptible to brain injury with additional considerations during the recovery process. Therefore, the focus of this review will be on presentation in adults.

In addition to cognitive changes, swallowing impairment (dysphagia) frequently occurs following TBI, with reports of incidence as high as 61% (Mackay et al., 1999). A variety of factors are believed to influence swallowing prognosis for these individuals including brain injury severity, presence or absence of a tracheostomy, ventilation duration, and cognitive and behavioral factors (Ward et al., 2007). The convergence of diminished cognitive function with dysphagia and the interaction of these sequelae make the diagnosis and treatment of dysphagia in this population particularly complicated.

During the rehabilitation process for dysphagia, methods of treatment and management often include compensatory strategies for oral intake that may require patients to follow specific instructions and make modifications to typical swallowing procedures. These alterations require adequate memory, attention, organization, sequencing, and impulse control for successful implementation by the patient without supervision. Thus, when adults with

TBI experience reduced cognitive control in any of these areas, this can conceivably affect their ability to regularly follow through with recommendations made by a speech-language pathologist.

Cognitive-communication and cognitive factors more generally can influence the feasibility of return to oral intake in patients with TBI (Cherney & Halper, 1989). Therefore, it is important for clinicians to understand the implications of these deficits and how they may interact with treatment recommendations and prognosis for dysphagia according to the available literature.

Objectives

The primary objective of this critical review is to evaluate literature regarding the impact of cognitive factors on swallowing outcomes in adults with TBI and dysphagia. Following from this, the secondary objective of this paper is to provide clinically relevant recommendations for practice and future directions for research in this area.

Methods

Search Strategy

Articles related to the topic of interest were located online using the following databases: PubMed, PsychINFO, Scopus, and CINAHL. Keywords used for database searches were the following:

[(brain injury) OR (TBI) AND (swallowing) OR (dysphagia) AND (cognitive communication) OR (cog*) OR (prognosis)]

Selection Criteria

The search criteria yielded articles that included both children and adults as participants. Only the articles that (at minimum) had adults as a subset of the participants were selected for the purposes of this review. Furthermore, only studies that directly

involved either cognitive outcome measures or a discussion of cognitive-communication as related to participants with TBI and dysphagia were included.

Data Collection

The previously outlined criteria resulted in 5 studies that were appropriate for selection. Two of these studies employed a case study design, while the remaining three papers employed a cohort design (two retrospective and one prospective).

Results

The Case Studies

Case studies are useful for conducting in-depth investigations of a particular situation that may lead to future research in an area of interest. However, this design is inherently subject to selection and recall bias and the limited scope does not lend itself to generalizability of findings.

A study by Cherney and Halper (1989) appears to report the earliest evidence for a relationship between cognitive-communication abilities and return to oral intake following brain injury. Two cases were presented along with basic descriptive statistics following a chart review of 36 patients with TBI at the Rehabilitation Institute of Chicago. Severity ratings for both oral intake and cognitive-communication were clearly described in this paper. For the case studies, detailed observations of cognitive function and videofluoroscopic findings were described for both patients. Therapy and management protocols implemented during the period of observation were listed, but not well described in some cases.

Appropriate analyses were used as an inroad to the question of interest; however, other variables that may have had an impact on outcomes, such as other neurological diagnoses, existing mental health disorders, and previous swallowing problems were not considered or listed as exclusion criteria. Frequency data from the chart reviews revealed that 53% of patients demonstrated improvements in their oral intake and also concomitant improvements in cognitive-communication status. One case study participant demonstrated improvements in cognitive status that paralleled advancement of oral intake status, while the other case study participant continued to experience difficulties in attention and orientation and simultaneously did not advance to oral intake status. Overall, findings from both the chart reviews and case studies indicated a possible relationship between return to oral intake and cognitive-communication status.

This study employed an appropriate, albeit weak, design, as well as appropriate outcome measures and qualitative analysis. It provides somewhat suggestive evidence that poor cognitive communication and/or behavioral status in adult patients with head injury may negatively influence the possibility of advancing oral intake status.

The second paper, authored by Halper, Cherney, Cicochowski, and Zhang (1999), examined the relationship between severity of functional oral intake and cognitive functioning for adult patients with TBI in an inpatient rehab setting. The study design utilized was a single group correlational study, which will be considered in the next section of this paper, along with two case studies. For the case studies, detailed observations of cognitive function and videofluoroscopic findings were described for both patients. Therapy and management protocols implemented during the period of observation were listed, but not well described, particularly in the case of cognitive intervention for Patient 1. Some attempt was made to quantify outcomes for both patients involved in the case studies through the use of a commonly employed measure of functional independence including a cognitive subscore, and a functional chewing/swallowing assessment.

The case study analyses were appropriate; however, other variables that may have had an impact on outcomes were not thoroughly considered (e.g., Patient 2 experienced many other medical complications). In addition, important patient variables that may have influenced outcomes, such as other neurological diagnoses, mental health disorders, and previous swallowing problems were not outlined. Findings from the case studies indicated an existing relationship between return to oral intake and cognitive-communication status.

The case studies in Halper et al. (1999) employed appropriate design, as well as appropriate outcome measures and analyses. They provide somewhat suggestive evidence that poor cognitive functioning in adult patients with TBI may negatively influence functional oral intake status.

The Single Group Study

Single group designs are appropriate for investigating questions regarding individuals with TBI; however, validity may be questioned due to lack of a control or comparison group. This presents a challenge for dismissal of competing hypotheses or interpretations.

In addition to case studies, Halper et al. (1999), examined data from patients with TBI (n=148) both at the time of admission and discharge. The study had quite a large age range (18-87 years) and there was also a wide range of time between onset and date of admission (4-982 days) among the participants. Cognitive functioning was evaluated using the same functional cognitive subscore utilized in the case studies and functional oral intake was evaluated using a chewing/swallowing scale. Adequate mention was made of procedures used to ensure acceptable reliability.

Appropriate descriptive statistics and correlational analyses were used to investigate the question of interest. Findings indicated a significant relationship between oral intake and cognitive-communication status at both admission and discharge.

The single-group correlational study demonstrated an appropriate design, as well as appropriate outcome measures and analyses. It provided highly suggestive evidence that poor cognitive functioning in adult patients with TBI may negatively influence functional oral intake status.

The Cohort Studies

Cohort studies examine a specific group with a trait of interest over time and are appropriate for long-term examination of hypotheses related to TBI. However, cohort studies may be prone to selection bias (due to loss of study participants) and measurement bias. Furthermore, if all confounding variables are not taken into consideration at the time of analyses, this can also negatively impact interpretation.

Mackay, Morgan, and Bernstein (1999) used a retrospective cohort design to examine the impact of factors including swallowing abnormality, brain injury severity, and age on oral intake status. Of these factors, only cognitive measures, which were included as a measure of brain injury severity, are of interest to the present review and will be considered here. Only patients with severe TBI were recruited (n=54), although the age range was wide and included both adults and children (14–70 years). Further information about the distribution of age was not provided. Data from commonly used videofluoroscopic swallowing studies (VFSS) were used for assessment of swallowing function and all scales and screens utilized in the study were routinely used measures. The cognitive measure important for the question of interest was divided into severity levels for analyses. Outcome measures were time to

initiate and achieve total oral feeding and percentage of abnormal swallowing indicators.

Appropriate descriptive statistics were reported in the form of *t*-tests. Patients with lower cognitive functioning levels had a significantly higher percentage of abnormal swallowing and took 2 – 2 ½ times longer to initiate and achieve total oral feeding. The cognitive measure was found to be the most important *independent* predictor of days to achievement of oral feeding.

This study utilized an appropriate design, as well as appropriate measures and analyses. It provides suggestive evidence that low cognitive function in severe TBI is associated with abnormal swallowing and longer time to initiate and achieve oral feeding.

In the second retrospective cohort study, Hansen, Engberg, and Larsen (2008) examined the incidence, status, and time to recovery of functional oral intake for patients with TBI in a subacute rehabilitation setting and the role of brain injury severity in the process. Only data for patients with TBI (n=173) and no previous swallowing problems due to neurologic diseases or other diagnoses were examined, although the age range was broad (16-65 years). Commonly used scales were utilized upon admission including a scale to assess cognitive function, a scale to assess brain injury severity/level of consciousness, and a scale for the assessment of functional independence, of which only the cognitive measure is of interest to the present study and will be considered here. Oral intake functionality was also assessed retrospectively as an outcome measure at admission, biweekly, and at follow-up. Acceptable intra-rater reliability was reported.

Appropriate nonparametric statistics in the form of Kaplan-Meier plots and Wilcoxon Signed Rank tests revealed that scores on the cognitive measure were associated with return to oral intake and time taken to achieve oral intake.

This study employed an appropriate design, as well as appropriate measures and analyses. It provides suggestive evidence that relatively higher scores on a cognitive measure can be a strong predictor of return to unrestricted dieting.

A prospective cohort study by Terré and Mearin (2007) examined the relationship between cognitive impairment in TBI and swallowing impairments, clinical evolution, and prognosis. Only patients with severe TBI and clinically suspected oropharyngeal dysphagia were recruited. The age range of

participants was quite extensive (11-63 years) and adequate information about distribution of age groups was not provided. Further relevant exclusion criteria, such as other neurological diagnoses, presence of mental health disorders, and occurrence of previous swallowing problems were also not indicated. Appropriate and commonly used measures including VFSS and a scale of cognitive function were delivered in this study.

Appropriate descriptive statistics and bivariate correlational analyses were reported. Significant correlations were found between cognitive impairment of TBI (as determined by score obtained on a cognitive measure) and swallowing impairment and also between cognitive function score and feeding mode at discharge. Additionally, findings indicated that improvement of cognitive status paralleled the resolution of dysphagia.

This study utilized an appropriate design, as well as appropriate measures and analyses. It provides suggestive evidence that scores on a commonly used cognitive measure are associated with feeding mode at discharge (i.e., clinical evolution) and the presence of swallowing impairments. Furthermore, there was some evidence that improvement of cognitive status coincided with the resolution of dysphagia.

Discussion

All of the studies examined in this review report that cognitive status or cognitive communication likely have some relationship with swallowing outcomes, specifically return to oral intake and swallowing abnormality. However, strength of the evidence is limited by weaknesses in participant exclusion criteria, methodology, and study design. Furthermore, all three of the cohort studies reviewed here included children as well as adult participants, although there are special considerations for children with TBI that were not discussed in the articles. Taken together, these factors impact the applicability of these findings in clinical practice.

Future Research Considerations:

A subset of this research, including the case studies, did not address prominent limitations inherent within the study design(s) (e.g., lack of generalizability and inability to determine causation). Further research is recommended to elucidate and establish the relationship between cognitive factors and swallowing outcomes. The following aspects should

be taken into consideration in order to elevate the level of evidence that is available in the literature:

- a) Future research should employ study designs with stronger levels of evidence combined with larger sample sizes in order to increase clinical applicability of findings.
- b) Exclusion criteria in future research should take into consideration medications that may alter cognitive status, other neurological diagnoses, certain mental health disorders, and presence of previous swallowing diagnoses.
- c) Researchers should further explore the use of cognitive interventions and how this may impact swallowing outcomes in adults with TBI.
- d) Researchers should investigate what aspects of cognitive function have the greatest impact on swallowing outcomes and why these relationships may exist.
- e) Incorporating more detailed cognitive measures into future research can assist in clarifying potential profiles of cognitive involvement in swallowing outcomes.

Clinical Implications

Overall, the evidence reviewed here is suggestive and clinical applicability of these results remains limited due to weaknesses in study design and inability to determine causation. It is recommended that clinicians exhibit caution when implementing these findings until further research is conducted.

Although the current critical review did not reveal a strong level of evidence supporting the relationship between cognitive factors and swallowing outcomes in adults with TBI, clinicians should be aware of the potential impact of cognitive function on swallowing and oral intake more generally in this population. As cognitive-communication is a growing area of focus in speech-language pathology, clinicians should remain cognizant of how assessment and treatment protocols may influence other functional outcomes in practice.

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