Critical Review: Does consumption of thickened fluids increase risk of dehydration in post-stroke patients?

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This critical review examines whether post-stroke patients on modified dysphagia diets of thickened fluids are at an increased risk of suffering from dehydration. Study designs include a repeated measure, crossover design, a randomized control trial with a qualitative survey component, a cohort study, an observational study with a qualitative focus group component, and two parallel group comparisons. Overall, research supports the statement that post-stroke patients suffering from dysphagia and on modified fluids are more likely to have poor oral intake of thickened fluids, and are at an increased risk of suffering from dehydration.

Introduction

Dysphagia is a term that describes the difficulty of transporting food and liquid from the mouth to the stomach (Logemann, 1998). A common cause of dysphagia is cerebral vascular accident (CVA) or stroke and it is estimated that swallowing difficulties following acute stroke can affect 43-45% of patients (Smithard et al., 1996). According to the report, *The Changing Face of Heart Disease and Stroke in Canada 2000* (1999), Canadians will see the incidence of stroke increase substantially over the coming years due to "the high prevalence rate of the major risk factors – age, smoking, physical inactivity, high blood pressure, dyslipidemias, obesity, and diabetes" – in the Canadian population (p. v). Due to the strong relationship between stroke and the outcome of dysphagia, it seems fair to predict that increasing incidence of stroke will also lead to an increase in the incidence of dysphagia.

Dysphagia resulting from a stroke is associated with poor outcomes due to health complications such as dehydration, malnutrition, weight loss, and aspiration (both silent and audible) (RCP, 2004). Aspiration (both silent and audible) is a major risk associated with dysphagia as it can result in pneumonia, which is the fourth most frequent cause of death in the elderly (Cunha, 1986). One way, in which Speech-Language Pathologists directly treat dysphagia and reduce the risk of aspiration, is to modify the consistency of the patient's diet (Logemann, 1991). Diet modifications often include measures that make foods and liquids more cohesive and thus easier to swallow. In the case of liquids, this often means thickening to various consistencies as needed (honey thick, nectar thick, pudding thick), using a commercial thickening agent (Ramage, Ross, and Hadden, 1998). Individuals on a dysphagia diet that includes thickened fluids have a reduced risk of aspirating fluid intake. These individuals, however, may be at an increased risk of suffering from dehydration as a result of poor oral intake. Poor oral intake is defined as ingestion of less than 1500 mL or 1500 cc of fluid per day. This daily fluid requirement amount was calculated using the following formula: 100mL/kg for the first 10 kg, 50 mL/kg for the next 10 kg, 15 mL/kg for each kg beyond 20 kg (Skipper, 1993).

Water comprises about 63% of the body and is an essential component in the metabolic process, the process of temperature regulation, and many other physiological processes within the body (Armstrong, 2005). Dehydration, or an "imbalance between intake and loss of fluid and the accompanying sodium and fluid status" (Leibovitz et al., 2007), is a substantial problem for post-stroke patients as it leads to poor health outcomes (Mentes, 2006). Maintaining proper hydration in the human body is vital for adequate functioning. Consequences of dehydration are not only detrimental to the individual experiencing the dehydration, but they are also extremely costly to the health care system. These consequences include urinary tract infections, upper and lower respiratory tract infections, acute confusion, falls, skin breakdown, constipation, increased concentration and effects of medications, and re-hospitalization of the dehydrated individual is often necessary (Chernoff, 1994; Leibovitz et al., 2007; Mentes, 2006).

Objectives

The primary objective of this paper is to critically evaluate whether post-stroke patients on modified dysphagia diets of thickened fluids are at an increased risk of suffering from dehydration.

Recommendations on how to prevent dehydration and improve oral intake of thickened fluids, as well as suggestions for future research will also be discussed.

Methods

Search Strategy

Computerized databases, including CINAHL, MEDLINE, and Cochrane Library were searched using the following search strategy: ((dysphagia) OR (deglutition dysfunction)) AND ((dehydration) OR (hydration))

Reference lists from articles were also used to obtain relevant studies.

The search was limited to articles written in English between 1980 and 2007.

Selection Criteria

Studies selected for inclusion in this critical review were required to investigate: assessments of thickened and/or thin fluid intake in adults, as well as any factors related to poor oral intake of thin and thickened fluids in adults.

Data Collection

Results of the literature search yielded the following types of articles (selected using the above mentioned criteria): randomized controlled trial (RCT) with a qualitative survey, crossover/repeated measures design, cohort study, observational study with qualitative component, and parallel group comparison design (2).

Results

Sharpe, Ward, Cichero, Sopade, and Halley (2007) completed two studies; one with rats and the other with 6 healthy human subjects. The intent of the study was to determine whether thickening agents affect water absorption rates in the gastro-intestinal tract, therefore predisposing individuals using thickening agents for swallowing safety, to dehydration. Each rat and human subject received 7 treatments consisting of different thickening agents in water and 1 control treatment of water. Water absorption was tested using blood samples taken before and after treatment. Results were analyzed using repeated measure analysis of variance models. Sharpe et al. (2007) reported that there were no statistically significant differences between the water absorption rates of the eight different treatments.

Garon, Engle, and Ormiston (1997) completed a randomized clinical trial to examine whether patients with dysphagia will increase oral intake of fluid, without developing pneumonia, if allowed access to thin water between meals. This RCT study included 20 post-stroke patients with documented aspiration of thin liquids. These subjects were randomly assigned to either the study group (patients allowed thickened fluids and thin water between meals) or the control group (patients allowed thickened fluids only). Upon completion of the study, Garon et al. (1997) also examined patient satisfaction related to fluid intake, using a multiple-choice questionnaire. Results were analyzed and revealed a statistically significant difference between the study and control group in regards to the amount of thickened fluids ingested by the subjects. It was also determined that the mean daily intake of fluids (both thickened and thin) for all subjects was well below the recommended, minimum daily fluid requirements.

Finestone, Foley, Woodbury, and Greene-Finestone (2001) examined whether post-stroke patients with dysphagia can meet the recommended, minimum daily fluid requirements using oral intake of thickened fluids as compared to non-oral fluid intake. This study recruited 7 patients who initially required non-oral feeding and improved enough to be allowed oral feeding (group one) and 6 patients who could initially tolerate oral feeding (group two). Daily fluid intake was recorded for both groups. Intra-group differences for group one patients were analyzed using a paired t-test and inter-group differences between the two groups were analyzed using an independent t-test. Finestone et al. (2001) reported a statistically significant decrease in fluid intake in group one patients as they progressed from non-oral to oral diets. The researchers also reported that group one subjects in the non-oral feeding phase consumed significantly more fluids than subjects in group two. Finestone et al. (2001) discovered that patients using non-oral feeding strategies were meeting and exceeding their daily fluid requirements and patients orally ingesting thickened fluids were consuming less than 50% of their required daily fluid intake.

Ramage et al. (1998) examined whether a recommendation of thickened fluids for patients with dysphagia is associated with insufficient oral intake. They also examined six common themes associated with thickened fluid intake using a qualitative study design. The quantitative component of this study examined one group of 29 patients with dysphagia, on a diet including thickened fluids. The total fluid and food intake for each subject was recorded for three consecutive days. Results were analyzed using descriptive statistics and they revealed that 96% of the subjects did not meet their recommended, minimum daily fluid intake. The qualitative section of the study tracked focus group sessions with hospital staff. Six recurring themes emerged from the focus groups and these themes dealt with the issues influencing why patients don't meet their recommended, minimum daily intake of fluids, strategies that may help to increase oral fluid intake of patients, and areas of information that require further research.

Whelan (2001) evaluated whether disability, ward specialty, or type of fluid given, affects oral intake for post-stroke patients with dysphagia. Twelve subjects were recruited from an acute stroke ward and 12 subjects were recruited from a non-specialist ward; all subjects were randomly assigned to one of two groups. Patients in group one were required to drink fluids thickened with a domestic powder thickener and patients in group two were required to drink commercial, pre-thickened fluids. All fluid intake was recorded over a period of 14 days (or until thickened fluids were no longer required). Results were analyzed and they revealed that patients on the non-specialist

ward drank significantly more pre-thickened fluids. An inverse association between disability and oral fluid intake (those with lower Barthel scores tended to drink less) was also noted. Whelan (2001) reported that no subject in the study met the minimum daily requirement of fluid intake, even when supplemented with non-oral fluid intake.

Patch, Mason, Curcio-Borg, and Tapsell (2003) completed a study with 63 patients suffering from dysphagia and on a modified diet including thickened fluids. Their aim was to compare intake of commercially pre-thickened fluids and domestic powder thickened fluids with regard given to overall wastage. The study subjects were randomly assigned to one of two groups, where group one received fluids thickened with a domestic powder thickener and group two received commercially prepared pre-thickened fluids. Fluid intake was recorded for a period of 14 days (excluding weekends). Results were analyzed using a two-tailed independent t-test. Patch et al. (2003) reported a statistically significant difference between the intake of both commercially pre-thickened fluids and domestic powder-thickened fluids offered at snack times when compared to meal times. It was also reported that, on average, patients drinking commercial pre-thickened fluids consumed 37% of the recommended, minimum daily fluid intake and, on average, patients drinking domestic powder-thickened fluids consumed 41% of the recommended, minimum daily fluid intake.

Discussion

The six studies reviewed in this critique contained commonalities in the areas of subject selection and sample size, methodology, and statistical analyses.

Power analysis is generally accepted as the best method for determining appropriate sample size, however none of the appraised literature included such calculations.

All studies utilized valid outcome measures, however no mention was made of measuring inter-rater/intra-rater reliability.

In all studies, no mention was made regarding the distribution characteristics of the population.

Sharpe et al. (2007)

The researchers completed two separate repeated measures/crossover design studies. In this comparative study design, each participant receives both the intervention and control in a random order (Greenhalgh, 2006). This design method controls for an order effect in the treatments as well as for individual differences in the subjects that may confound results.

Sharpe et al. (2007) selected a sample of adult male rats as well as a non-random sample of 6 healthy, human volunteers. The sample of human subjects had an unequal distribution of males to females (5:1) and the subjects had an age range of 37-58 years. As these results are being generalized and applied to the elderly, post-stroke population it would have been more valid and appropriate to include an equal distribution of males and females, as well as an older age range in order to control for age and sex related differences in gastro-intestinal absorption.

The researchers outlined their experimental procedures in great detail and as such, this study is reproducible. Rigorous testing on both rats and humans with multiple blood and saliva measurements at specific time increments increased this study's reliability. No mention was made of blinding participants or researchers at any level, nor was any mention made of whether measurement was completed using a single rater vs. multiple raters.

A major limitation of this study is the issue of generalizing the results. The subjects in this study were healthy volunteers and the ability to absorb water from thickened fluids in the gastrointestinal tract may be affected by factors such as age and illness.

In conclusion, Sharpe et al. (2007) completed a meticulous, highly reliable and reproducible study with some limitations in the area of validity and generalizability. The findings of this study can be considered moderately strong evidence.

Garon et al. (1997)

These researchers completed a randomized control trial, the gold standard in clinical research design. In this study, subjects are randomly assigned to a control or treatment group (Greenhalgh, 2006).

Garon et al. (1997) selected 20 post-stroke patients with dysphagia, and randomly assigned 10 to a treatment group and 10 to a control group. Subject inclusion and exclusion criteria were well documented and detailed lists of patient characteristics were noted. The researchers acknowledged that the small sample size was an issue, and findings would have been different had the sample size been larger.

The study included a control and treatment group, and comparison and measurement was made between intake of thickened fluids and thin fluids versus thickened fluids only. Researchers selected patients who had documented aspiration verified by a video fluoroscopic study. The researchers fully described independent and dependent variables, as well as moderator variables that may have acted as possible confounds due to the relatively small sample size. Experimental procedures were thoroughly outlined with the exception of the statistical methods utilized to analyze the data. Researchers provided feeding staff, caregivers, and family members with education

regarding how to measure fluid intake of the subject, thus increasing the reliability of the measurement data.

In conclusion, Garon et al. (1997) completed a well-designed, valid randomized control trial with some limitations in the area of subject size, documentation of statistical methods, and reproducibility. The findings of this study can be considered moderately strong evidence.

Finestone et al. (2001)

The researchers conducted a cohort study design, which involves non-random subject selection and allocation into two or more groups and is useful for examining whether a person will develop a certain condition (Greenhalgh, 2006).

A sample of post-stroke patients with dysphagia was consecutively selected from a hospital over a 14-month period. The researchers non-randomly allocated the subjects to two different treatment groups. Patients in Group one (n=7) were initially receiving nourishment from non-oral means and then progressed to oral feeding. Patients in Group two (n=6) were safe to start oral intake straight away. The issues of small sample size, non-randomized group allocation, large age-range and unequal distribution of sex negatively affect the validity of the study's results.

Subjects involved in this preliminary study had a diagnosis of dysphagia made using a bedside swallow exam and no mention was made of the subjective nature of this test and how this may have affected the studies' reliability. Measurement of fluid intake for patients in Group one, initially on enteral/parenteral and intra-venous feeding were very thorough. Measurement of food and fluid intake for patients on oral feeding (Group one patients in the sub-acute stage and Group two patients in the acute stage) was conducted over a shorter period of time (2 days as opposed to 5) and no mention was made as to who was measuring the oral intake (ie. nursing staff or researchers). The insufficient procedural information would make this study difficult to reproduce.

In conclusion, Finestone et al. (2001) completed this preliminary study that contained many methodological limitations, but provided detailed documentation of patient's fluid intake. The findings of this study can be considered weak to moderate evidence.

Ramage et al. (1998)

These researchers completed an observational study where subjects were selected and observed, and results were then analyzed. The addition of a qualitative, focus group component allowed researchers to find out *why* certain results emerged.

Ramage et al. (1998) consecutively selected 29 patients with dysphagia from both acute and extended care units and grouped all patients together for the study. The sample contained a fairly equal distribution of males and females, however the individuals in the sample had a large range of ages (18-95 years of age). The researchers also conducted a qualitative portion of the study by way of focus group discussion with nursing staff, speech-language pathologists, and dieticians.

The quantitative component of the study included one group of non-randomly selected subjects with dysphagia. There was no discussion regarding how diagnosis of dysphagia was made. There was also no mention as to whether any education or training was provided for the patient feeders who recorded all food and fluid intake. Researchers noted that the Hawthorne effect was taken into account by conducting additional fluid intake observations with 10 subjects, who still met selection criteria, after two months. The qualitative component of this study included 3 initial focus group sessions held with nursing staff involved with feeding, as well as a secondary focus group session, following theme and data analysis, with speech-language pathologists, resource nurses, and dieticians. The focus group themes may have been more valid had the views of patients, caregivers, and family members been taken into account. No mention was made as to whether the researchers' biases and perspectives were taken into account.

In conclusion, Ramage et al. (1998) completed a flawed quantitative study with methodological limitations. However, this is the first appraised article that contained a qualitative investigation into the difficult issue, "*why* is thickened fluid intake so poor?" The findings of this study can be considered moderate evidence.

Patch et al. (2003)

A parallel group comparison was utilized for this study. This comparative design allows researchers to compare the effects of two different treatments (Greenhalgh, 2006).

Patch et al. (2003) consecutively selected 63 patients on modified fluid diets. The researchers randomly allocated patients into one of two treatment groups. Subjects in group one (n=36) received commercially prepared pre-thickened fluids, and subjects in group two (n=27) received domestic powder thickened beverages. The researchers were not able to observe all patients at the same time therefore 38 patients (26 from group one and 12 from group two) were observed at snack times and 25 patients (10 from group one and 15 from group two) were observed at mealtimes. The differences in observation times may have affected the reliability of the studies' results.

Patch et al. (2003) completed a study with well-documented procedures and as such, this study is reproducible. The researchers consecutively selected patients with a diagnosis of dysphagia made using a

bedside assessment and confirmed using a videofluoroscopic study. Researchers hired a nutrition assistant to measure fluid intake of all subjects and observations were made at mealtimes and snack times.

In conclusion, Patch et al. (2003) completed a well-designed, well-documented study with few methodological limitations. The findings of this study can be considered moderately strong evidence.

Whelan (2001)

Similar to Patch et al. (2003), Whelan (2001) completed a parallel group comparison study.

Twenty-four post-stroke patients with dysphagia and on modified fluids, were consecutively recruited. Twelve subjects were from a stroke unit and 12 were from a non-specialist unit. These patients were then randomly allocated to one of two treatment groups. Group one (n=13) received powder thickened fluids and Group two (n=11) received pre-thickened fluids. There was no mention of the distribution of males and females in this study and there were no exclusion criteria in order to maximize sample size. These variables could have acted as confounding variables and therefore affected the representativeness of the sample.

Dependent and independent variables were well defined and the study's procedural methods were clearly outlined, however the researchers failed to document the statistical methods used for data analysis. Diagnosis of acute stroke in each subject was made using symptomology, computerized tomography, or magnetic resonance imaging, and diagnosis of dysphagia was made using a clinical bedside exam. No mention was made regarding the possible unreliability of the different methods used to diagnose CVA and dysphagia. Feeding staff were presented with information regarding how to measure fluid intake, which increased reliability of fluid measurement. Researchers also monitored chest infection and urinary tract infection in each subject as signs of dehydration, which increased the validity of the outcome measures.

In conclusion, Whelan (2001) completed a study containing limitations in the area of sample size, methodology, and statistical analyses. The findings of this study can be considered weak to moderate evidence.

Conclusions

Despite some variability in the quality of the appraised literature, this research provides moderately strong evidence that individuals with dysphagia, on a modified diet that includes thickened fluids, are at an increased risk of becoming dehydrated.

This information is crucial for guiding practitioners in their work, as well as for illuminating areas that require further research.

Recommendations

Further Research

Upon examination of the results of the appraised literature, it is evident that further research is necessary to continue to build on the abovementioned conclusions. It would be highly beneficial if a study was conducted into rate of patient non-compliance when thickened fluids have been recommended. Anecdotal evidence already suggests that patient non-compliance is high. Further qualitative research into the subjective factors that influence a patient's decision to refuse thickened fluids would also be highly beneficial.

Future research should also address some of the gaps in the existing research appraised in this critique. A secondary study building on the findings of Sharpe et al. (2007) would allow researchers to address the issue of possible differences in gastro-intestinal water absorption abilities when subjects are elderly and unwell.

Clinical Implications

Despite some methodological and sampling issues in the appraised research, it is apparent that hospitalized individuals drinking thickened fluids are at risk for poor fluid intake and eventually dehydration. It seems most appropriate that Speech-Language Pathologists working with this population need to be proactive in their practice in order to prevent dehydration before it can occur. The easiest way to accomplish this is through education of patients, family members, caregivers, and feeding staff. Education should be provided regarding: minimum required daily intake of fluid; the poor health outcomes associated with poor fluid intake and dehydration; the signs of dehydration; and hydration maintenance strategies.

Speech-Language Pathologists can also help to increase patient compliance following a recommendation of thickened fluids. For example, clinicians can provide clients with samples of the different kinds of thickeners so that patients may find a product that suits his/her lifestyle and taste.

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