



Just add water

Can water protocols improve dysphagia management outcomes?

Joanne Murray, Allison Barker, and Sebastian Doeltgen

There have been many advances in the rehabilitation of dysphagia over the past decade, yet compensatory strategies, particularly food and fluid modification, tend to dominate speech-language pathology practice. This paper explores the evidence for the use of thickened fluids as one such compensatory strategy for managing the risk of aspiration pneumonia, and revisits the evidence for water protocols (WP) as an alternative. Findings from systematic reviews suggest water protocols do not increase the odds of pneumonia in carefully selected patients, particularly those in inpatient rehabilitation with acquired neurological conditions, with trends towards improved fluid intake, hydration and quality of life. Yet the uptake of WPs into clinical practice remains sporadic. In the second part of this paper we raise questions about the barriers to the uptake of WPs as a stimulus for discussion within the profession.

The aim of dysphagia assessment and intervention is to manage aspiration risk, ensure adequate nutrition and hydration, and to improve patient and carer quality of life. The last decade has seen many advances in the science underpinning the assessment and management of dysphagia, which have improved our understanding of the physiology of dysphagia and its pathological correlates. Much of this research has focused on developing new approaches to facilitate the recovery of impaired swallowing function, including biofeedback-assisted swallowing skill or strength training (Huckabee & Macrae, 2014). The development of new rehabilitation approaches is in keeping with the ever-growing pressure on health care providers to demonstrate the efficacy of their interventions in the context of shrinking health care budgets and increasing patient throughput.

Despite these developments, compensatory strategies continue to dominate speech-language pathology (SLP) practice, particularly diet modification. Surveys of SLP practice in Australia and in the USA reveal that

compensatory strategies related to diet modification remain the most common intervention recommended by up to 98% of speech-language pathologists (SLPs) (Carnaby & Harenberg, 2013; Rumbach, Coombes, & Doeltgen, 2018). In contrast, the use of research-supported exercise-based rehabilitation approaches, such as the headlift exercise (Antunes & Lunet, 2012) or effort-based swallowing exercises (Wheeler-Hegland, Rosenbek, & Sapienza) is sparse, with only 19% of respondents in a USA-based survey reporting using exercise-based therapy as their primary intervention. Even in the last iteration of the Clinical Guidelines for Stroke Management 2017, no new exercise-based rehabilitation strategies received a specific recommendation for implementation (Stroke Foundation, 2017).

We pursued two primary aims when writing this article. First, we aimed to briefly summarise the currently available literature on the compensatory strategy of modified (thickened) fluids and an alternative fluid regime, water protocols (WPs). Relevant peer-reviewed publications were identified through several independent searches of the PubMed, Scopus and Google Scholar databases using keywords of “oropharyngeal dysphagia”, “adults”, “aspiration pneumonia”, “rehabilitation”, “hydration”, “water protocols”, “free water protocols” and “thickened liquids”. By its very nature, this paper is intended as an overview only and does not claim to represent an exhaustive search of the existing literature. Second, we reflect on current practice in relation to WPs and raise a number of questions about future directions for research and clinical implementation of this management modality as a stimulus for discussion within the profession.

Thickened fluids – pros and cons

Individuals with dysphagia of a neurological origin are more likely to aspirate thin fluids than thicker or more solid bolus consistencies (Bülow, Olsson, & Ekberg, 2003; Kuhlemeier, Palmer, & Rosenberg, 2001; Logemann, 1998). Thickening a liquid reduces its flow rate and enables greater intra-oral and pharyngeal bolus control, thereby reducing aspiration risk before and during swallowing (Logemann, 1998). A recent systematic review of swallowing physiology concludes that as fluid viscosity increases, aspiration risk during the swallow decreases (Steele et al., 2015). However, as thickened fluids are more dense, they require greater strength of the tongue and pharyngeal musculature to propel them through the oropharynx. As a result,

KEYWORDS

DYSPHAGIA
REHABILITATION
STROKE
THICKENED FLUIDS
WATER PROTOCOLS

THIS ARTICLE
HAS BEEN
PEER-
REVIEWED



Joanne Murray (top), Allison Barker (centre), and Sebastian Doeltgen

thickened fluids are more likely to cause post-swallow pharyngeal residue than thin fluids, increasing the potential for post-swallow aspiration (Steele et al., 2015).

The lack of evidence about the impact of thickened fluids on patients' longer term health outcomes, beyond specific aspects of swallowing physiology, is often lamented by the research community. The most recent update of the stroke guidelines from the UK highlights the lack of evidence as to whether withdrawing (nil by mouth) or thickening fluids reduces the incidence of pneumonia (National Institute for Health and Care Excellence, 2008, updated 2017). One randomised control trial (RCT) that did evaluate health outcomes for individuals with Parkinson's disease or dementia who had thin-liquid aspiration found that over the course of three months, pneumonia rates did not differ between patients who were prescribed chin-down posture with thin fluids compared with those prescribed (nectar or honey thick) thickened fluids (Robbins, Gensler, Hind, Logemann, Lindblad, Brandt & Miller Gardner, 2008). Interestingly, more patients assigned to the thickened fluids group developed dehydration, urinary tract infection and/or fever compared to those in the chin-down posture group drinking thin fluids (Robbins et al., 2008).

As has been demonstrated previously in the literature, not all aspiration events will lead to pneumonia; instead, the development of aspiration pneumonia is multifactorial and dependent on the health status of the individual, their immune response, respiratory status, oral and dental health, functional abilities and medical comorbidities (Langmore, Terpenning, & Schork, 1998). Furthermore, the characteristics of the aspirate (volume, pH level and bacterial load) are also important in determining pneumonia risk (Marik, 2001). The risk of developing pneumonia or of dying increases with aspiration of thickened fluids or more solid materials as compared with thin fluids (Schmidt, Holas, Halvorson, & Reding, 1994). As such, diagnostic specificity and accuracy in relation to a patient's ability to tolerate thickened fluids is critical; if inaccurate, the intervention designed to reduce aspiration risk may inadvertently lead to greater risk to the health of the individual.

Expanding the discussion beyond aspiration, it has also been reported that many patients do not enjoy drinking thickened fluids (Colodny, 2005; McCurtin et al., 2018). These individuals are, therefore, frequently non-compliant with diet modification recommendations (Low, Wyles, Wilkinson, & Sainsbury, 2001) and at risk of not consuming sufficient fluids. Total fluid intake has consistently been reported as inadequate for individuals with dysphagia on modified diet and fluids, especially if reliant of oral intake alone (Murray, Miller, Doeltgen, & Scholten, 2014; Vivanti, Campbell, Suter, Hannan-Jones, & Hulcombe, 2009). Further, individuals with dysphagia on modified food and fluids have been shown to be more dehydrated than their peers without dysphagia in acute settings (Crary, Carnaby, Shabbir, Miller, & Silliman, 2016; Crary et al., 2013; Whelan, 2001), inpatient rehabilitation settings (Murray, Scholten, & Doeltgen, 2018) and when compared to the community-dwelling elderly (Luszcz et al., 2007). If monitored and recognised early enough, alternative means of hydration such as intravenous or nasogastric delivery of fluids can be initiated in the acute care setting. However, dehydration from insufficient fluid intake raises concerns for patients in rehabilitation and community settings where medical intervention is less prevalent.

Water protocols

Over the past three decades, WPs have emerged as a potentially feasible alternative to fluid modification. First coined the "Frazier Free Water Protocol", clinicians at the Frazier Rehabilitation Institute in the USA have allowed patients to drink water under strict conditions since 1984 (Panther, 2005), arguing that aspirating small quantities of water, as a pH neutral substance, would not harm the lungs. The rules of WPs stipulate that patients with known thin-liquid aspiration can drink water between meals, but not with food or medication, and only with rigorous oral hygiene and close monitoring. The water is offered in addition to their prescribed thickened fluids (unless they are nil by mouth) and patients can choose how much of the water they wish to consume (Panther, 2005).

Over the subsequent years, several RCTs have been conducted to evaluate the safety and efficacy of WPs (Carlaw et al., 2012; Karagiannis, Chivers, & Karagiannis, 2011; Murray, Doeltgen, Miller, & Scholten, 2016; Pooyania, Vandurme, Daun, & Buchel, 2015), along with two cohort studies (Bernard, Loeslie, & Rabatin, 2015; Frey & Ramsberger, 2011) and one single group pre-post intervention design (Karagiannis & Karagiannis, 2014). The majority of studies were conducted in inpatient rehabilitation settings with participants with a diagnosis of stroke or other acquired neurological conditions (Carlaw et al., 2012; Garon, Engle, & Ormiston, 1997; Murray et al., 2016; Pooyania et al., 2015) but sample sizes tended to be small and methodological quality of the studies varied. All of the studies measured the outcome of pneumonia, although none had sufficient participants in their sample to provide adequate statistical power for this outcome measure. One study measured other health outcomes and found that participants on a WP had improved hydration and significantly fewer diagnoses of urinary tract infection, compared with those in a thickened fluids only group who qualitatively presented with a worsening of hydration levels (Murray et al., 2016). In this same study, participants in the WP group resolved their dysphagia for thin fluids faster than those on thickened fluids only (Murray et al., 2016), a finding in keeping with an earlier randomised controlled trial (Garon et al., 1997). This finding might suggest that allowing patients to "practice" drinking thin fluids in the relatively safe form of water may promote recovery of swallowing function, in accordance with the principles of experience dependent neuroplasticity (Kleim & Jones, 2008).

The existing evidence about WPs has recently been summarised and critiqued in two systematic reviews and meta-analyses (Gillman, Winkler, & Taylor, 2017; Kaneoka et al., 2017). The meta-analyses for the outcome of pneumonia concluded that WPs did not result in significantly increased rates of lung complications compared with thickened fluids. There were also benefits of quantitatively increased fluid intake (although results of the meta-analysis did not reach statistical significance) and improved patient quality of life. However, the evidence was rated as low quality due to small sample sizes and heterogeneity in populations and methods used. As such, the findings of these systematic reviews need to be interpreted cautiously. The results are applicable to patients with low risk of pneumonia only since patients with known risk factors for pneumonia were excluded from the study populations (Kaneoka et al., 2017). Consequently, recommendations are that carefully selected adult rehabilitation inpatients, who do not have degenerative

neurological conditions and who are relatively mobile with reasonably intact cognition can be given access to WPs (Gillman et al., 2017). Notably, the importance of the oral hygiene component of the WP in mitigating other risk factors for pneumonia was highlighted by the authors of the primary studies.

A short-coming of published research to date is that WPs have not been evaluated across all of the main clinical diagnoses which cause dysphagia nor in all of the settings in which SLPs manage dysphagia. The majority of studies have evaluated WPs in inpatient neuro-rehabilitation settings with little evidence available from the acute setting, despite attempts having been made to specifically recruit participants from this setting (Karagiannis et al., 2011; Murray et al., 2016). Similarly, there are no published RCTs about the efficacy of WPs in community settings, including residential aged care, although the findings from one observational study of allowing supervised tea, coffee or water in an aged care facility were promising (Scott & Benjamin, 2010). Furthermore, RCTs conducted to date have had small sample sizes despite the large numbers of patients that present to hospitals or live in residential care with dysphagia. This suggests that there may be barriers that are unique to certain contexts or patient groups which warrant further exploration.

To date, the implementation of WPs into routine clinical practice has been sporadic (Langdon, 2009). One cohort study reporting retrospectively on the outcomes of a WP found that over three years only 16% of their rehabilitation inpatients had been put on a WP (Frey & Ramsberger, 2011). Similarly, a survey of Australian health professionals (SLPs, dietitians and nurses) reported that only 14% of respondents thought of WPs as a solution to inadequate fluid intake and management of dehydration (Murray, Doeltgen, Miller, & Scholten, 2014). Interestingly, respondents in this survey were more inclined to upgrade their patient to thin fluids despite the suspicion they were still aspirating thin fluids, rather than implement a formalised WP.

Future directions

One might interpret the existing research evidence to raise the question as to whether SLPs are overprescribing thickened fluids and consequently being unnecessarily restrictive with what they allow patients to drink in an attempt to avoid aspiration. Uptake of WPs remains limited, although as clinicians with the highest ethical standards, SLPs strive to always incorporate best available evidence from research into clinical practice. The reasons for the slow uptake of WPs into routine clinical practice are likely multifactorial. It is possible that heavy workloads limit time for developing and implementing new protocols that require support from many disciplines. It is also possible that local work culture, perceptions of risk, and institutional policies around risk management contribute to the barriers of implementing WPs. Further education may be required in SLP undergraduate training courses along with ongoing professional development to ensure that, collectively as a profession, SLPs are aware of any new evidence-based approaches to dysphagia management. Perhaps there are clinical populations and settings where clinicians are unsure about the safety of WPs and are awaiting further empirical evidence prior to implementing WPs on a broader scale. Positively, the latest guidelines for stroke from the UK has targeted the evaluation of free access to water compared to withdrawal or modifying fluids as its primary research

strategy for combating aspiration pneumonia (National Institute for Health and Care Excellence, 2008, updated 2017). These multifactorial barriers require further in-depth exploration so that clinical pathways and guidelines can be systematically developed to support the transition of WPs from research applications to routine clinical practice.

The authors of this article are currently exploring some of these factors in more detail in acute stroke and general medicine settings by interviewing clinicians from multiple disciplines working in acute hospitals. The foci include perceptions of the benefits and risks of WPs in this setting, what patient populations or characteristics clinicians identify as suitable or unsuitable for a WP, and what are the perceived enablers and barriers of WP implementation in acute settings. Preliminary findings from the acute stroke setting appear to suggest a lack of awareness of WPs in general, the importance of complying with the WP rules, especially oral care, and how to monitor patient outcomes. Perceptions of risks, especially aspiration, and presence of barriers to implementing WPs were also raised.

Concluding remarks

A growing body of evidence supports the benefits of WPs as a management approach for dysphagia in selected patient populations. However, at the same time, evidence is beginning to outline the real and perceived barriers to the more widespread implementation of WPs into clinical practice. Together, these bodies of research will support the development of clinical guidelines and pathways that may facilitate the clinical uptake of WPs in the future. The authors hope that this article may reinvigorate an interest in WPs and inspire discussion of the potential merits (and risks) across settings and professions involved in the management of dysphagia.

References

- Antunes, E. B., & Lunet, N. (2012). Effects of the head lift exercise on the swallow function: a systematic review. *Gerodontology, 29*(4), 2472–57. doi:10.1111/j.1741-2358.2012.00638.x
- Bernard, S., Loeslie, V., & Rabatin, J. (2015). Use of a modified Frazier water protocol in critical illness survivors with pulmonary compromise and dysphagia: A pilot study. *American Journal of Occupational Therapy, 70*(1), 1–5. doi:10.5014/ajot.2016.016857
- Bülow, M., Olsson, R., & Ekberg, O. (2003). Videoradiographic analysis of how carbonated thin liquids and thickened liquids affect the physiology of swallowing in subjects with aspiration on thin liquids. *Acta Radiologica, 44*(4), 366–372.
- Carlaw, C., Finlayson, H., Beggs, K., Visser, T., Marcoux, C., Coney, D., & Steele, C. M. (2012). Outcomes of a pilot water protocol project in a rehabilitation setting. *Dysphagia, 27*(3), 297–306. doi:10.1007/s00455-011-9366-9
- Carnaby, G. D., & Harenberg, L. (2013). What is “usual care” in dysphagia rehabilitation: A survey of USA dysphagia practice patterns. *Dysphagia, 28*(4), 567–574. doi:10.1007/s00455-013-9467-8
- Colodny, N. (2005). Dysphagic independent feeders’ justifications for noncompliance with recommendations by a speech-language pathologist. *American Journal of Speech-Language Pathology, 14*(1), 61–70. doi:10.1044/1058-0360(2005/008)
- Crary, M. A., Carnaby, G. D., Shabbir, Y., Miller, L., & Silliman, S. (2016). Clinical variables associated with

- hydration status in acute ischemic stroke patients with dysphagia. *Dysphagia*, 31(1), 60–65. doi:10.1007/s00455-015-9658-6
- Crary, M. A., Humphrey, J. L., Carnaby-Mann, G., Sambandam, R., Miller, L., & Silliman, S. (2013). Dysphagia, nutrition, and hydration in ischemic stroke patients at admission and discharge from acute care. *Dysphagia*, 28(1), 69–76. doi:10.1007/s00455-012-9414-0
- Frey, K., & Ramsberger, G. (2011). Comparison of outcomes before and after implementation of a water protocol for patients with cerebrovascular accident and dysphagia. *Journal of Neuroscience Nursing*, 43(3), 165–171. doi:10.1097/JNN.0b013e3182135adf
- Garon, B. R., Engle, M., & Ormiston, C. (1997). A randomized control study to determine the effects of unlimited oral intake of water in patients with identified aspiration. *Neurorehabilitation and Neural Repair*, 11(3), 139–148.
- Gillman, A., Winkler, R., & Taylor, N. (2017). Implementing the free water protocol does not result in aspiration pneumonia in carefully selected patients with dysphagia: A systematic review. *Dysphagia*, 32(3), 345–361. doi:10.1007/s00455-016-9761-3
- Huckabee, M., & Macrae, P. (2014). Rethinking rehab: Skill-based training for swallowing impairment. *Perspectives on Swallowing and Swallowing Disorders (Dysphagia)*, 23(1), 46–53. doi:10.1044/sasd23.1.46
- Kaneoka, A., Piseigna, J. M., Saito, H., Lo, M., Felling, K., Haga, N., & Langmore, S. E. (2017). A systematic review and meta-analysis of pneumonia associated with thin liquid vs. thickened liquid intake in patients who aspirate. *Clinical Rehabilitation*, 31(8), 1116–1125. doi:10.1177/0269215516677739
- Karagiannis, M., Chivers, L., & Karagiannis, T. (2011). Effects of oral intake of water in patients with oropharyngeal dysphagia. *BMC geriatrics*, 11(1), 1. doi:10.1186/1471-2318-11-9
- Karagiannis, M., & Karagiannis, T. (2014). Oropharyngeal dysphagia, free water protocol and quality of life: An update from a prospective clinical trial. *Hellenic Journal of Nuclear Medicine*, 1, S26–S29.
- Kleim, J. A., & Jones, T. A. (2008). Principles of experience-dependent neural plasticity: implications for rehabilitation after brain damage. *Journal of Speech, Language, and Hearing Research*, 51(1), S225–S239. doi:10.1044/1092-4388(2008/018)
- Kuhlemeier, K. V., Palmer, J. B., & Rosenberg, D. (2001). Effect of liquid bolus consistency and delivery method on aspiration and pharyngeal retention in dysphagia patients. *Dysphagia*, 16(2), 119–122. doi:10.1007/s004550011003
- Langdon, C. (2009). Free Water Protocols: A review of the evidence. *ACQuiring knowledge in speech, language and hearing*, 11(1), 36–42.
- Langmore, S. E., Terpenning, M. S., & Schork, A. (1998). Predictors of aspiration pneumonia: How important is dysphagia? *Dysphagia*, 13, 69. doi:10.1007/PL00009559
- Logemann, J. A. (1998). The evaluation and treatment of swallowing disorders. *Current Opinion in Otolaryngology & Head and Neck Surgery*, 6(6), 395–400.
- Low, J., Wyles, C., Wilkinson, T., & Sainsbury, R. (2001). The effect of compliance on clinical outcomes for patients with dysphagia on videofluoroscopy. *Dysphagia*, 16(2), 123–127. doi:10.1007/s004550011002
- Luszcz, M., Giles, L., Eckermann, S., Edwards, P., Browne-Yung, K., & Hayles, C. (2007). *The Australian longitudinal study of ageing: 15 years of ageing in South Australia*. Adelaide, SA.
- Marik, P. E. (2001). Aspiration pneumonitis and aspiration pneumonia. *The New England Journal of Medicine*, 344, 665–671. doi:10.1056/NEJM200103013440908
- McCurtin, A., Healy, C., Kelly, L., Murphy, F., Ryan, J., & Walsh, J. (2018). Plugging the patient evidence gap: what patients with swallowing disorders post-stroke say about thickened liquids. *International Journal of Language & Communication Disorders*, 53(1), 30–39. doi:10.1111/1460-6984.12324
- Murray, J., Doeltgen, S., Miller, M., & Scholten, I. (2014). A survey of thickened fluid prescribing and monitoring practices of Australian health professionals. *Journal of evaluation in clinical practice*, 20(5), 596–600. doi:10.1111/jep.12154
- Murray, J., Doeltgen, S., Miller, M., & Scholten, I. (2016). Does a water protocol improve the hydration and health status of individuals with thin liquid aspiration following stroke? A randomized controlled trial. *Dysphagia*, 31(3), 424–433. doi:10.1007/s00455-016-9694-x
- Murray, J., Miller, M., Doeltgen, S., & Scholten, I. (2014). Intake of thickened liquids by hospitalized adults with dysphagia after stroke. *International journal of speech-language pathology*, 16(5), 486–494. doi:10.3109/17549507.2013.830776
- Murray, J., Scholten, I., & Doeltgen, S. (2018). Factors contributing to hydration, fluid intake and health status of inpatients with and without dysphagia post stroke. *Dysphagia*. doi:10.1007/s00455-018-9886-7
- National Institute for Health and Care Excellence. (2008, updated 2017). Stroke and transient ischaemic attack in over 16s: diagnosis and initial management (CG68). Retrieved from nice.org.uk/guidance/cg68/
- Panther, K. (2005). The Frazier free water protocol. *Perspectives on Swallowing and Swallowing Disorders (Dysphagia)*, 14(1), 4–9.
- Pooyania, S., Vandurme, L., Daun, R., & Buchel, C. (2015). Effects of a free water protocol on inpatients in a neuro-rehabilitation setting. *Open Journal of Therapy and Rehabilitation*, 3, 132–138. doi:10.4236/ojtr.2015.34018
- Robbins, J., Gensler, G., Hind, J., Logemann, J. A., Lindblad, A. S., Brandt, D., Miller Gardner, P. J. (2008). Comparison of 2 interventions for liquid aspiration on pneumonia incidence: A randomized trial. *Annals of internal medicine*, 148(7), 509–518. doi:10.7326/0003-4819-148-7-200804010-00007
- Rumbach, A., Coombes, C., & Doeltgen, S. (2018). A survey of Australian dysphagia practice patterns. *Dysphagia*, 33(2), 216–226. doi:10.1007/s00455-017-9849-4
- Schmidt, J., Holas, M., Halvorson, K., & Reding, M. (1994). Videofluoroscopic evidence of aspiration predicts pneumonia and death but not dehydration following stroke. *Dysphagia*, 9(1), 7–11. doi:10.1007/bf00262752
- Scott, A., & Benjamin, L. (2010). Implementation of a free fluid protocol in an aged care facility. In H. Roddam & J. Skeat (Eds.), *Embedding evidence-based practice in speech and language therapy: International examples* (pp. 184–188). Chichester, UK: John Wiley & Sons.
- Steele, C. M., Alsanei, W. A., Ayanikalath, S., Barbon, C. E., Chen, J., Cichero, J. A., . . . Giosa, L. (2015). The influence of food texture and liquid consistency modification on swallowing physiology and function: a systematic review. *Dysphagia*, 30(1), 2–26. doi:10.1007/s00455-014-9578-x
- Stroke Foundation. (2017). *Clinical Guidelines for Stroke Management 2017*. Melbourne, Australia.
- Vivanti, A. P., Campbell, K. L., Suter, M. S., Hannan-Jones, M. T., & Hulcombe, J. A. (2009). Contribution of thickened drinks, food and enteral and parenteral fluids

to fluid intake in hospitalised patients with dysphagia. *Journal of Human Nutrition and Dietetics*, 22(2), 148–155. doi:10.1111/j.1365-277X.2009.00944.x

Wheeler-Hegland, K.M., Rosenbek, J., & Sapienza, C.M. (2008). Submental sEMG and hyoid movements during Mendelsohn maneuver, effortful swallow, and expiratory muscle strength training. *Journal of Speech, Language, and Hearing Research*, 51, 1072–1087. doi:10.1044/1092-4388(2008/07-0016)

Whelan, K. (2001). Inadequate fluid intakes in dysphagic acute stroke. *Clinical Nutrition*, 20(5), 423–428. doi:10.1054/clnu.2001.0467

Dr Joanne Murray is a lecturer in speech pathology at Flinders University. **Allison Barker** is a recent graduate of Flinders University currently working at Hampstead Rehabilitation Centre. **Dr Sebastian Doeltgen** is a senior lecturer in speech pathology at Flinders University.

Correspondence to:

Joanne Murray

Flinders University

phone: 08 7221 8825

email: Joanne.murray@flinders.edu.au