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Use of Oral Hydration Protocols for Dysphagic Patients Following Stroke

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Abstract

Purpose: The aim of the study was to describe the use of oral hydration protocols for dysphagic patients following stroke.

Design and Methods: We reviewed inpatient records for patients able to take food and liquids orally within 30 days of an ischemic stroke. Orders were hierarchically defined with three levels of liquid consistency modification (LCM) and six levels of augmented hydration orders (AHOs). Change from admission to discharge in hydration and functional independence measure (FIM) scores across LCM and AHO groups was assessed.

Findings: Length of stay, admission FIM, discharge FIM, and change in FIM scores were all significantly related to LCM and AHO group assignment. Need for supplemental intravenous hydration was low (6.9%) over the 2-year study period and was significantly related to both LCM and AHO group assignment.

Conclusion and Clinical Relevance: The association of LCM and AHO interventions with functional outcomes and need for intravenous fluids helps to validate their clinical utility.

Keywords: Dysphagia; hydration status; Stroke Rehabilitation Team.

Introduction

Maintaining adequate hydration for dysphagic patients following stroke is generally considered to be an important component for optimizing rehabilitation outcomes (Bloomfield & Pegram, 2012; Finestone & Greene-Finestone, 2003; Kedlaya & Brandstater, 2002; Masrur et al., 2013; Schrock, Glasenapp, & Drogell, 2012). The Guidelines for Adult Stroke Rehabilitation and Recovery published jointly in May 2016 by the American Heart Association and the American Stroke Association highlights the need for systematic dysphagia screening, dysphagia management, and nutritional support (Winstein et al., 2016). The majority of available research suggests that dehydration has a negative impact on cognitive and motor skills (Grandjean & Grandjean, 2007; Kedlaya & Brandstater, 2002; Masento, Golightly, Field, Butler, & van Reekum, 2014; Riebl & Davy, 2013; Rodrigues et al., 2015; Schrock et al., 2012). There are, however, few research studies of the effect of alternative hydration management strategies on stroke recovery (Bloomfield & Pegram, 2012; Kedlaya & Brandstater, 2002; Perry, Hamilton, Williams, & Jones, 2013). These are usually published in nutrition and dysphagia journals (Grandjean & Grandjean, 2007; Masento et al., 2014; Rodrigues et al., 2015). We were unable to find outcome studies focused on the management of oral hydration on a busy inpatient stroke rehabilitation nursing unit (Bloomfield & Pegram, 2012; Masrur et al., 2013).

One significant limitation in available research is that there is no gold standard for measuring hydration status (Churchill, Grimm, & Reding, 2004; Grandjean & Grandjean, 2007; Kedlaya & Brandstater, 2002; Masento et al., 2014; Riebl & Davy, 2013; Schrock et al., 2012). Each study gives evidence-based reasons for their selected hydration measure. Percent body loss of 2% in fluid is a commonly used marker associated with negative outcomes; however, even less than 2% can result in negative implications for cognitive performance (Riebl & Davy, 2013). Furthermore, percent weight change is hard to establish in terms of its source, as it could be due to loss of water, fat, or muscle (Faraco et al., 2014; Riebl & Davy, 2013).

The complex but predictable interaction of fluid intake, electrolyte balance, and renal fluid and electrolyte excretion argues for the use of serum sodium (Na), blood urea nitrogen (BUN), creatinine (Cr), and the BUN/Cr ratio as good indicators of hydration status. These

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biomarkers are readily available and provide the benefit of consistency across practice settings and with previous research (Faraco et al., 2014; Grandjean & Grandjean, 2007; Masento et al., 2014; Riebl & Davy, 2013; Rodrigues et al., 2015).

Dysphagia increases risk of both malnutrition and dehydration (Iizuka & Reding, 2005). Risk of significant dysphagia increases progressively with stroke, affecting the left hemisphere, right hemisphere, bilateral hemispheres, and brainstem. The frequency of dysphagia following stroke has been reported to be from 42% to 75%, depending on the interval following stroke, stroke size and location, and dysphagia assessment tool used to define it: bedside clinical screening test, Modified Barium Swallow, or Fiberoptic Endoscopic Evaluation Swallow With Sensory Test (DePippo, Holas, Reding, Mandel, & Lesser, 1994; Finestone & Greene-Finestone, 2003; Logemann, 1998).

Background

Dysphagia may be managed with diet and liquid consistency changes. Liquid consistency modifications (LCMs) will improve control of fluid boluses and the amount, ease, and safety of swallowing. Liquid consistency modifications providing nectar- or honey-thickened liquids in place of thin liquids may be poorly received by the patient and exacerbate dehydration, which they are intended to mitigate (DePippo et al., 1994; Finestone & Greene-Finestone, 2003). Added risk for dehydration for those with dysphagia can be attributed to more compromised ability to self-feed and the use of starch-based thickening agents, which reduce the free water content provided in a comparable amount of pure water (DePippo et al., 1994).

Calorie-nutritional deficits produce changes in weight and metabolism over several days to several weeks. Dehydration, however, develops much more quickly with an obligate fluid loss of approximately 1.5 L/day, if not more. Inattention to concomitant diuretic usage for management of hypertension and congestive heart failure can further accentuate problems with maintaining oral hydration (Churchill et al., 2004; DePippo et al., 1994).

The goal of dysphagia management is to optimize fluid and nutritional intake, minimize risk of aspiration pneumonia, and enhance survival and recovery (DePippo et al., 1994; Finestone & Greene-Finestone, 2003; Masrur et al., 2013; Winstein et al., 2016).

In an attempt to optimize hydration in dysphagic patients, it is reasonable to establish a transdisciplinary protocol for providing varying levels of assistance to help patients meet their hydration needs. Those with more severe dysphagia require more significant LCMs and more staff assistance and encouragement to consume the appropriate amount. Nursing staff are an integral component of any protocol to provide appropriate supervised fluid intake 24 hours per day 7 days per week (Bloomfield & Pegram, 2012).

The focus of the current study was to assess the frequency of use and outcomes associated with implementation of a stroke team dysphagia hydration protocol using graded LCM and augmented hydration orders (AHOs) as defined below. Team members and responsibilities are as listed in the Methods section below.

Methods

This retrospective observational study was completed with Human Use Committee approval. We reviewed Health Information Portability Accountability Act compliant computerized medical records for patients admitted to our acute inpatient stroke rehabilitation unit over a 24-month period. Burke Rehabilitation Hospital is a free-standing 150-bed acute rehabilitation facility. Patients are admitted an average of 16.2 days poststroke and have a mean length of stay of 20.7 days. Inclusion criteria for participation in the oral hydration protocol were initial or recurrent ischemic stroke within 30 days of admission to the Stroke Rehabilitation Unit and the ability to take food, liquids, and medications by mouth. Patients with history of aspiration pneumonia and ongoing aspiration risk sufficient to require continued nonoral feeding were excluded. Also excluded were patients with congestive heart failure requiring a diuretic, chronic kidney disease with creatinine greater than 2.5 mg/dl or SIADH (syndrome of inappropriate antidiuretic hormone) with serum sodium of <130 mMol/L. There were no age restrictions.

We recorded LCM strategies that provide progressively more viscous liquids of either nectar or honey consistency to improve bolus control and protection from aspiration (Murray, Doeltgen, Miller, & Scholten, 2014; Panther, 2005). We also recorded AHOs, which were used to increase the frequency, consistency, and total amount of liquids consumed: (1) offering 250 ml of appropriate consistency liquid to be given by the patient's therapists during each of the patient's multidisciplinary therapy sessions; (2) a specified amount (250 ml) of an appropriate consistency liquid can also be ordered as a medication to be administered and recorded under nursing supervision three to five times per day; and (3) initiation of a free water protocol, allowing appropriately screened patients to sip small volumes of water between meals following oral-dental cleansing after each meal (Churchill et al., 2004; Finestone & Greene-Finestone, 2003; Kedlaya & Brandstater, 2002; Logemann, 1998; Panther, 2005). It is important to note that the free water protocol includes a provision that nursing staff cleanse the mouth and teeth with a moistened oral swab after each meal. This allows reasonable assurance that particulate matter will not be aspirated and that small sips of free water (without dissolved additives) can be given safely.

The need for LCM and AHOs was evaluated on admission to the stroke rehabilitation unit by the patient's speech–language pathology (SLP) dysphagia therapist and stroke rehabilitation physician based on transfer records from the acute care hospital, admission serum hydration markers, bedside swallow evaluation, and, if needed, Fiberoptic Endoscopic Evaluation Swallow With Sensory Test or Modified Barium Swallow. Patients with dysphagia were treated daily by the team SLP and LCM, and AHOs were changed based on patient performance and communicated to the rest of the patient's rehabilitation team at weekly meetings. In addition, a color-coded card was attached to the patient's therapy schedule coded as follows: red = no liquids by mouth; green = need to encourage 250 ml of oral liquids with each therapy program session specifying A = any liquid consistency, N = nectar consistency liquid, H = honey consistency liquid, F = free water protocol. Serum hydration parameters were repeated by the physician as needed during the rehabilitation hospital stay, and adherence to the oral hydration protocol was rehearsed at weekly stroke rehabilitation team meetings attended by all members of the interdisciplinary team.

Adherence to the oral hydration protocol was further assured by nursing staff who supervised and assisted dysphagic patients at each meal. Nursing staff were given in-service training by the patient's dysphagia therapist for appropriate compensatory swallowing techniques, LCM, and diet consistency modifications appropriate for each patient. LCM and diet consistency modification were also incorporated into the patient's dietary program by the team dietitian. Each patient's color-coded hydration management protocol was attached to their rehabilitation program schedule card, which was attached to their wheelchair, and accompanied the patient throughout the day. The presence of a color-coded hydration management protocol indicated to each of the team therapists that the patient was to receive 3 oz of an appropriate liquid with each program. For patients requiring more aggressive oral hydration, the computerized Nursing Medication Administration Record prompted the timing and amount of oral hydration to be offered and recorded under direct nursing supervision.

Each LCM and AHO and its date were recorded, as were the date and result of all the aforementioned serum hydration parameters obtained during the rehabilitation hospital stay (Churchill et al., 2004; Kedlaya & Brandstater, 2002; Schrock et al., 2012). Patients having two or more LCM or AHOs during the course of their rehabilitation hospital stay were assigned to the most restrictive group for which orders were written. The above multidisciplinary oral hydration protocol evolved over time but was stable and operational for at least 1 year prior to the start of this retrospective chart review. Functional independence measure (FIM) scores were recorded by therapy team members on admission and discharge and were used to assess stroke-related disability and to assess functional improvement based on change in scores from admission to discharge (Stineman & Maislin, 2000). The average admission FIM score for our stroke unit is 44.8, with a mean increase of 22.7 points from admission to discharge. These values compare favorably with other published regional and national stroke rehabilitation facilities.

Standard demographic data were also recorded: age, gender, and interval from stroke onset to admission to our stroke rehabilitation unit. Data analysis focused on the need for LCM and AHOs as independent variables with admission, discharge, change in FIM scores, and serum hydration parameters serving as dependent variables. LCM categories considered were (1) all liquid consistencies allowed (A), (2) need for nectar consistency liquids (N), and (3) need for honey consistency liquids (H). AHOs were grouped into six categories of increasing intensity of multidisciplinary stroke team involvement as shown in Table 1. Differences in hydration parameters across LCM and AHO groups were assessed using analysis of variance (ANOVA). A two-tailed probability statistic

Table 1 Definition of the three LCM and six AHO study groups

LCM Group 1: All liquid consistencies allowed	
LCM Group 2: Only nectar or honey thick liquids allowed	
LCM Group 3: Only honey thick liquids allowed	
AHO Group 1: No AHO required	O
AHO Group 2: Free water protocol only	F
AHO Group 3: Push 250 ml of appropriate consistency liquid with each therapy program	P
AHO Group 4: Give specified amount and frequency of appropriate consistency liquid as a medication order, to be administered and recorded by nursing staff	N
AHO Group 5: Two or more of the above AHOs	FP, FN, PN,
AHO Group 6: All three of the above AHOs	FPN

Note. LCM = liquid consistency modification; AHO = augmented hydration order; O = no AHO required; F = free water protocol; P = order for Occupational Therapist, Physical Therapist and SLP to push 250 ml of specified consistency of liquid with each therapy program; N = nursing nonformulary medication order to give *X* ml of specified consistency of liquid *X* times per day to be recorded as a medication in the medication record.

of .05 or less was considered significant. The strength of association between treatment group assignment, serum hydration, and functional status marker was assessed using the effect size statistic (Eta) for each ANOVA as calculated using SPSS Software. Eta values vary from 0 to 1, with values of 0.3 or greater indicating a clinically relevant effect size. The relative clinical importance of different variables can therefore be assessed using this statistic. Small sample sizes and unequal variance for LCM and AHO treatment groups precluded use of more elaborate analysis of covariance techniques. SPSS Software Version 22, IBM Corporation, was used for all statistical analyses.

Results

A total of 712 patients met inclusion–exclusion criteria. Of these, 675 were judged to be safe swallowing all liquid consistencies, 33 were prescribed nectar consistency liquids, and 4 required honey consistency liquids.

Table 2 shows that there is a statistically significant difference in the mean age, length of rehabilitation hospital stay, admission FIM, discharge FIM, change in FIM scores, and FIM efficiency for each of the three LCM patient groups.

Table 3 shows that admission serum sodium was normal, but that BUN and BUN/Cr ratios were mildly elevated for each LCM group, indicating mild dehydration at the time of discharge from the acute care hospital even with the ready availability of supplemental intravenous hydration. Given this predisposition for dehydration, however, serum sodium, BUN, and BUN/Cr ratios all remained stable or slightly improved during the rehabilitation hospital stay for each LCM treatment group.

Table 4 shows statistically significant differences in the clinical parameters for the six progressively more intensely managed AHO patient groups: age, length of rehabilitation hospital stay, admission FIM, discharge FIM, and gain in FIM score from admission to discharge.

Table 5 shows serum hydration parameter results for all six AHO patient groups. Statistical differences were found in the clinical parameters across AHO patient groups for admission and discharge serum sodium and BUN and for discharge BUN/Cr ratio.

Most importantly, within-group analyses showed no significant deterioration in hydration parameters from admission to discharge for any of the AHO treatment groups.

The number of patients in each AHO group who required supplemental intravenous hydration in addition to their specified oral hydration differed significantly based on AHO group assignment as follows: AHO Group 1 = 4.4%; AHO Group 2 = 54.5%; AHO Group 3 = 5.5%; AHO Group 4 = 16.7%; AHO Group 5 = 12.2%; AHO Group 6 = 33.3%; Pearson chi-square = 54.8, $p < .001$. The decision to supplement oral intake with intravenous hydration was a clinical judgment made by the patient's attending physician based on the patient's clinical appearance, severity and rate of change in BUN, BUN/Cr ratio, and serum sodium parameters during the course of the patient's inpatient rehabilitation hospital stay.

The LCM and AHO protocols were able to be consistently applied over a 2-year period on a 30-bed inpatient stroke rehabilitation unit, with stable or slight improvement in hydration parameters. For Year 1 versus Year 2, the mean serum sodium values were 141.1 ± 3 versus 140.9 ± 3, $F(1,3183) = 2.8$, $p = .09$, BUN was 24.5 ± 11 versus 23.5 ± 10, $F(1,3182) = 6.12$, $p = .01$, and BUN/Cr ratio was 25.1 ± 8 versus 24.5 ± 9, $F(1,3182) = 3.06$, $p = .08$. The need for supplemental intravenous hydration was likewise low and stable 23/330 = 7% for Year 1

Table 2 Clinical features of patients based on liquid consistency modification group

	Age	LOS	AFIMMS	DFIMMS	FIM Gain	FIM Eff
LCM Order Group	Mean (*SD*)	Mean Days (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
LCM Group 1 $n = 675$	75 (10)	20 (8)	28 (11)	52 (17)	30 (13)	1.7 (1.2)
LCM Group 2 $n = 33$	82 (8)	15 (11)	17 (7)	28 (14)	14 (13)	1.1 (1.8)
LCM Group 3 $n = 4$	83 (3)	21 (13)	13 (2)	30 (31)	24 (35)	1.3 (1.3)
ANOVA	$F(2,711) = 8.8$ $p < .001$ eta = 0.16	$F(2,711) = 7.5$ $p < .01$ eta = 0.14	$F(2,711) = 18.2$ $p < .001$ eta = 0.22	$F(2,711) = 36.7$ $p < .01$ eta = 0.31	$F(2,711) = 22.2$ $p < .001$ eta = 0.24	$F(2,711) = 4.3$ $p < .05$ eta = 0.11

Note. LCM = liquid consistency modification; LOS = length of stay; AFIMMS = admission functional independence measure motor subscore; DFIMMS = discharge functional independence measure motor subscore; FIM Gain = functional independence measure gain; FIM Eff = functional independence measure efficiency (change in FIM score per day); eta = effect size.

Table 3 Serum hydration parameters for patients based on liquid consistency modification group

LCM Group	Adm Sodium	Adm BUN	Adm BUN/Cr Ratio	Disc Sodium	Disc BUN	Disc BUN/Cr Ratio	ANOVA Change Sodium	ANOVA Change BUN	ANOVA Change BUN/Cr
LCM Group 1 *n* = 674	141 ± 3	22.7 ± 10	23.8 ± 8	141 ± 3	22.1 ± 9	23.8 ± 8	$F(1,1145) = 0.6$ $p = .42$ eta = 0.24	$F(1,1143) = 1.0$ $p = .31$ eta = 0.03	$F(1,1144) = 0.002$ $p = .97$ eta = 0.001
LCM Group 2 *n* = 33	142 ± 3	26.9 ± 12	28.4 ± 10	141 ± 2	25.2 ± 15	28.2 ± 9	$F(1,57) = 1.4$ $p = .25$ eta = 0.15	$F(1,57) = 0.3$ $p = .62$ eta = 0.07	$F(1,57) = 0.005$ $p = .94$ eta = 0.01
LCM Group 3 *n* = 4	140 ± 5	23.8 ± 3	24.2 ± 6	138 ± 5	21.0 ± 4	22.2 ± 3	$F(1,7) = 0.2$ $p = .7$ eta = 0.2	$F(1,7) = 1.3$ $p = .3$ eta = 0.42	$F(1,7) = 0.4$ $p = .56$ eta = 0.24
ANOVA	$F(2,710) = 1.2$ $p = .29$, eta =0.06	$F(2,709) = 2.4$ $p = .09$ eta = 0.08	$F(2,709) = 2.8$ $p = .06$ eta = 0.09	$F(2,500) = 2.9$ $p = .55$ eta = 0.11	$F(2,500) = 1.9$ $p = .15$ eta = 0.09	$F(2,500) = 6.9$ $p = .001$ eta = 0.16			

Note. Results reported as mean ± *SD*. LCM = liquid consistency modification; Adm = admission; Disc = discharge; eta = effect size; BUN = blood urea nitrogen; Cr = creatinine.

and 26/382 = 6.8 % for Year 2, chi-square = 0.009, $p = .92$.

Discussion

Our data show that LCM and AHOs can be developed to provide a hierarchy of progressively more aggressive attempts to avoid aspiration of thin liquids and maintain hydration. These orders guided by the SLP dysphagia therapist and written by the physician can be transmitted to Dietary, Nursing, and Therapy teams to provide comprehensive transdisciplinary support throughout the inpatient stroke rehabilitation stay. The goal for each patient is to provide the least restrictive orders needed to assure safe and effective oral hydration. This goal obviously cannot be met without the full support and active participation of the rehabilitation nursing staff responsible for patient care 24 hours per day 7 days per week (Bloomfield & Pegram, 2012).

This retrospective observational study also shows that the need for LCM and AHOs was associated with significantly different admission FIM, discharge FIM, and change in FIM scores. Although not showing causation, it implies that minimizing the risk of liquid aspiration and optimizing hydration improve stroke outcomes.

The need for an LCM order is easily identified by the patient's SLP dysphagia therapist, ordered by the patient's physician, and communicated to the Dietary Department, the Stroke Rehabilitation Team, the patient, and the patient's family. The patient's dysphagia status is reviewed on a regular basis by the patient's SLP dysphagia therapist with the goal being to liberalize liquid consistency as soon as safely possible. Need for an LCM or AHO prompts the physician to periodically reassess serum hydration markers to assure adequate hydration is being provided.

If serum hydration parameters are abnormal, then AHOs can be written, again in a clearly defined and progressively more regimented manner, to provide additional fluid intake. Tables 4 and 5 show that serum sodium, BUN, and BUN/Cr ratio differ across AHO groups, as these are the parameters used to progressively intensify

Table 4 Clinical features of patients based on augmented hydration order group number

AHO Group Number	Age	Length of Stay	Admission FIM Score	Discharge FIM Score	FIM Gain
AHO Group 1 *n* = 309	73.6 ± 11	18.5 ± 9	50.2 ± 16	81.0 ± 22	30.8 ± 14
AHO Group 2 *n* = 11	76.6 ± 7	17.1 ± 12	32.8 + 11	55.7 ± 23	22.9 ± 20
AHO Group 3 *n* = 289	76.5 ± 9	21.1 ± 8	45.1 ± 15	74.2 ± 22	29.1 ± 13
AHO Group 4 *n* = 6	86.2 ± 2	21.7 ± 4	41.2 ± 18	77.7 ± 16	36.5 ± 8
AHO Group 5 *n* = 91	78 ± 10	22.1 ± 8	36.1 ± 14	61.6 ± 23	25.5 ± 13
AHO Group 6 *n* = 6	83.8 ± 9	15.5 ± 7	28.5 ± 13	42.8 ± 31	14.3 ± 18
ANOVA	$F(5,711) = 5.9$ $p < .001$ eta = 0.2	$F(5,711) = 4.6$ $p < .001$ eta = 0.18	$F(5,711) = 15.7$ $p < .001$ eta = 0.32	$F(5,711) = 15.8$ $p < .001$ eta = 0.32	$F(5,711) = 4.4$ $p = .001$ eta = 0.18

Note. Results reported as mean ± *SD*. AHO = augmented hydration order; FIM = functional independence measure; eta = effect size.

Table 5 Hydration–electrolyte parameters for patients based on augmented hydration order group

AHO Group	Adm Sodium	Adm BUN	Adm BUN/Cr Ratio	Disch Sodium	Disch BUN	Disch BUN/Cr Ratio	ANOVA for Change in Sodium	ANOVA for Change in BUN	ANOVA for Change in BUN/Cr
AHO Group 1 $n = 309$	141 ± 3	22.2 ± 7	23.2 ± 8	141 ± 3	17.9 ± 6	21.8 ± 7	$F(1,444) = 0.13$ $p = .72$	$F(1,443) = 11.7$ $p = .001$	$F(1,443) = 3.2$ $p = .07$
AHO Group 2 $n = 11$	140 ± 4	21.9 ± 10	23.1 ± 9	140 ± 4	18.7 ± 5	22.2 ± 6	$F(1,19) = 0.13$ $p = .72$	$F(1,19) = 0.84$ $p = .37$	$F(1,19) = 0.07$ $p = .8$
AHO Group 3 $n = 289$	141 ± 3	23.2 ± 10	24.3 ± 8	141 ± 2	22.2 ± 8	24.6 ± 8	$F(1,512) = 0.02$ $p = .9$	$F(1,512) = 1.6$ $p = .2$	$F(1,512) = 0.12$ $p = .7$
AHO Group 4 $n = 6$	140 ± 4	25.2 ± 7	26.8 ± 12	138 ± 5	29.4 ± 10	25.5 ± 4	$F(1,14) = 0.35$ $p = .6$	$F(1,14) = 0.75$ $p = .4$	$F(1,14) = 0.1$ $p = .8$
AHO Group 5 $n = 91$	142 ± 3	28.8 ± 12	25.3 ± 8	141 ± 3	30.1 ± 12	26.0 ± 10	$F(1,204) = 7.8$ $p = .006$	$F(1,204) = 0.54$ $p = .5$	$F(1,204) = 0.26$ $p = .6$
AHO Group 6 $n = 6$	142 ± 1	21.1 ± 4	24.4 ± 10	141 ± 1	22.2 ± 8	33.4 ± 11	$F(1,13) = 0.16$ $p = .7$	$F(1,13) = 0.11$ $p = .74$	$F(1,13) = 2.5$ $p = .14$
ANOVA	$F(5,710) = 3.6$ $p = .003$ eta = 0.16	$F(5,709) = 13.9$ $p < .001$ eta = 0.3	$F(5,709) = 1.4$ $p = .22$ eta = 0.1	$F(5,500) = 3.1$ $p = .01$ eta = 0.17	$F(5,500) = 24.6$ $p < .001$ eta = 0.45	$F(5,500) = 5.3$ $p < .001$ eta = 0.23			

Note. Results reported as mean ± *SD*. AHO = augmented hydration order; BUN = blood urea nitrogen; Cr = creatinine; Adm = admission; Disch = discharge.

Key Practice Points

- The need for trans-disciplinary hydration management is related to both stroke severity and to rehabilitation outcomes.
- Implementing a trans-disciplinary hydration protocol can minimize the need for supplemental intravenous hydration.
- Hierarchically structured Liquid Consistency Modification and Augmented Hydration orders can be clearly defined.
- Trans-Disciplinary Protocols for maintenance of hydration are feasible in an Acute Stroke Rehabilitation environment.

hydration efforts. Using this approach, the admission to discharge hydration values were maintained at acceptable levels without significant deterioration through the duration of the rehabilitation hospital stay.

There are inherent limitations and biases to this research. This is a retrospective observational study resulting in the inability to monitor adherence to protocols. Another inherent bias is that the severity of stroke, and likely dysphagia, results in more viscous liquid requirements (which provide less free water per ounce than pure water compounding the risk for dehydration) and need for AHOs.

Our data show that we are applying transdisciplinary LCM and AHOs in a logical, consistent, and conservative manner. Our data also show that, with our current protocol, patients are able to keep relatively stable blood hydration parameters with minimal use of supplemental intravenous hydration (6.9% of patients).

We assessed possible improvement from Year 1 to Year 2 of the study to determine if better, more practiced use of the LCM and AHOs resulted in better discharge hydration labs. As shown by our results presented above, there was a trend for lower mean sodium, BUN, and BUN/Cr ratios for Year 2 of the study, but only serum BUN reached statistical significance. The need for supplemental intravenous hydration remained stable, also indicating consistent effects of LCM and AHOs over time.

Conclusions

Interdisciplinary LCM and AHO interventions can be initiated in a step-wise manner based on the severity of dysphagia. Significant differences in hydration parameters, need for supplemental intravenous hydration, and functional outcomes based on LCM and AHO group assignment help validate their use.

Acknowledgment

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