5-2017

Dehydration in Nursing Home Residents: A meta-analysis of causes of dehydration, implications, and those most at risk.

Carolyn Grace Miller

Dehydration in Nursing Home Residents:

A meta-analysis of causes of dehydration, implications, and those most at risk.

An Honors College Project Thesis

Presented to

The Department of Kinesiology and Nutrition

Abilene Christian University

In Partial Fulfillment

of the Requirements for

Honors Scholar

by

Carolyn Grace Miller

May 2017

This Project Thesis, directed and approved by the candidate's committee, has been accepted by the Honors College of Abilene Christian University in partial fulfillment of the requirements for the distinction

HONORS SCHOLAR

_____

Dr. Jason Morris, Dean of the Honors College

_____

Date

Advisory Committee

_____

Dr. Sheila Jones, Committee Chair

_____

Dr. Martha Smallwood, Committee Member

_____

Dr. Patricia Hernandez, Committee Member

_____

Dr. Sheila Jones, Department Head

Abstract

Dehydration in nursing home and long term care facility residents is frequently dismissed and not treated as a primary concern. However, research has shown that prolonged dehydration in the elderly can result in serious health and cognitive issues. Due to deteriorating physiological conditions and preexisting diseases, dehydration will further complicate a patient's health condition and exacerbate certain symptoms, lowering overall quality of life. There are a number of underlying factors which contribute to a patient's hydration status. Research has identified physical, mental and behavioral factors all play a significant role in the willingness and capability of patients to be properly hydrated. In addition, it has been shown that caretakers are critical when it comes to ensuring patient hydration. If effective hydration screening is implemented and caretakers encourage patients to increase their fluid intake, fewer dehydration episodes will occur and the overall quality of life will be improved.

Dehydration in Nursing Home Residents:

A meta-analysis of causes of dehydration, implications, and those most at risk.

As the body ages, basic physiologic and psychologic functions begin to break down. Depending on the individual, the senses diminishes along with other things such as cognitive function. For some this deterioration is mild and progresses slowly. For others, aging has more serious implications. Dementia and dehydration are both common issues found in many nursing homes. Researchers have found that if a patient has dementia, they are at an increased risk for dehydration. In a survey of eight different nursing home facilities, 76.1% of all participants had dementia, and 68.8% of all participants were either dehydrated or classified as having impending dehydration (Marra et al., 2015, p. 832). Dehydration status not only can affect cognitive function, but it also can increase the risk of urinary tract infections, respiratory infections, and constipation (Mentes, 2006, p. 14). A combination of these otherwise preventable issues can lead to severe consequences for patients.

The Roles of Kidneys on Hydration

One factor in the hydration status of geriatric patients is how well the kidney functions. The kidneys have some of the largest impact on fluid control in the body. Their functional units are called nephrons, which is where most of the filtration takes place. One kidney contains approximately 1 to 1.5 million nephrons. The nephrons all contain a capillary system called the glomerulus. Blood is filtered through the glomerulus to excrete or reabsorb necessary water, electrolytes, glucose, amino acids, and other metabolic waste. Collectively this concentrate is called the glomerular filtrate. During a period of no disease or injury, blood and protein is not present in the filtrate due to their

larger size which is unable to diffuse through the pores of the capillary endothelium. Depending on the body's needs, for electrolyte intake and blood volume, the glomerulus will adjust either excretion and reabsorption of fluids or electrolytes to maintain homeostasis. A healthy kidney is capable of filtering substances at 130 mL/minute, which is referred to as the glomerular filtration rate (GFR). This rate results in approximately 187 L of filtrate produced every day (Gropper & Smith, 2013, p. 457-8).

During renal disease, whether acute or chronic, the GFR is greatly reduced. As a result, protein and fluid are often restricted, both of which are crucial in the wellbeing and longevity of a geriatric patient. Two of the largest risk factors for chronic kidney disease (CKD) are diabetes mellitus and hypertension, both of which are common in older populations (Mahan, Escott-Stump, & Raymond, 2012, p. 811-4). According to the Centers for Disease Control and Prevention (CDC), 25.9% of people over the age of 65 have either Type 1 Diabetes Mellitus (T1DM) or Type 2 Diabetes Mellitus (T2DM) (Center of Diseases Control and Prevention, 2014). Of men between the ages of 65 and 74, 64.0% have hypertension and 69.3% women in the same age group have hypertension (CDC, 2016). The percentages increase in people 75 and older. Therefore, the increased risk for kidney disease and associated risk factors in those over 65 can result in complicated nutrition and fluid support, potentially affecting hydration status.

Stages of Chronic Kidney Disease

Stage	Estimated GFR	Description of Stage
Stage 1 CKD	90-130 mL/min	The kidney is damaged but still functions independently.
Stage 2 CKD	60-89 mL/min	Mildly decreasing kidney function.

Stage 3 CKD	30-59 mL/min	There is moderate decrease in kidney function, dialysis not yet needed.
Stage 4 CKD	15-29 mL/min	Severe depletion in kidney function, dialysis may begin during this stage.
Stage 5 CKD	<15 mL/min	Treatment for kidney failure is imperative, considered end-stage renal disease.

Hormone Influences on Hydration

The hormone vasopressin and the renin-angiotensin aldosterone system work in combination with each other on the kidneys to maintain fluid balance. Vasopressin is made in the hypothalamus, and is stored in and secreted from the pituitary gland in the brain. Its secretion is stimulated by a drop in intravascular volume or by the elevation of extracellular water osmolality. When vasopressin is released in response to increased extracellular fluid, the sensation of thirst is induced. Vasopressin affects the kidneys in two ways: acting as an antidiuretic and promoting limited sodium retention. As an antidiuretic, the presence of vasopressin aids in the reabsorption of water in the distal convoluted tubule. It also regulates sodium reabsorption and excretion by binding to V2 receptors which affect Na+ channels. Typically, approximately 80% of water is reabsorbed from the filtrate, and with vasopressin present water absorption is further increased (Gropper & Smith, 2013, p. 458-9).

The other hormonal system involved in the kidneys' function on fluid balance is the renin-angiotensin aldosterone system (RAAS). A general rule of the body is that water follows sodium. Primarily, RAAS controls sodium retention and potassium excretion. When renin is secreted by the glomerulus as a result of decreased plasma sodium, chloride, extracellular fluid volume, or blood pressure, it hydrolyzes free

circulating angiotensin I in addition to hydrolyzing angiotensin converting enzyme (ACE). This hydrolyzation activates the peptide angiotensin II, which in turn stimulates aldosterone and vasopressin production and secretion. Angiotensin II also acts as a vasoconstrictor, subsequently raising blood pressure. The stimulated aldosterone then ultimately increases sodium absorption by embedding additional sodium channels into the Loop of Henle. The promotion of increased sodium absorption then culminates in increased water reabsorption from the glomerular filtrate (Gropper & Smith, 2013, p. 459-60).

Possible Causes of Reduced Hydration in the Elderly

If the body has such a complex and intricate method for maintaining fluid balance, why are so many patients in nursing homes dehydrated or at risk for dehydration? One factor is simply that as a body ages there is a decrease in lean muscle mass, which equates to less total body water content (Marra et al., 2015, p. 829). Another reason is that hormonal mechanisms such as the vasopressin and RAAS receptiveness deteriorate or are lost as a person ages. The body may no longer respond to an elevated serum osmolality by stimulating the thirst sensation. In cases of patients with diabetes, uncontrolled blood glucose spikes also elevate overall serum osmolality since glucose is a substance in serum osmolality. Similar to reduced insulin sensitivity in T2DM due to unchecked blood glucose, researchers believe the repeated sudden spikes in serum osmolality may also create an insensitivity to triggering hormones when serum osmolality increases or decreases (Hooper, 2016, p. 776). Collectively these complications can result in poor regulation of fluid balance.

As previously mentioned, kidney disease can have a major impact on fluid balance and hydration. As a person ages, they are increasingly exposed to risk factors of kidney disease such as renal stones or acute kidney injury. Additionally, they have a greater chance of having obesity, cerebrovascular disease, and hypertension, which are also major risk factors in kidney disease. When renal blood flow is reduced, glomerular function declines and allows undesirable protein and blood leakage into the urine (Lowth, 2016). As the risk for kidney disease increases, so does the risk for fluid and electrolyte imbalances.

Researchers suspect that certain medications to control hypertension may also play a role in kidney function. Though RAAS and ACE inhibitors improve the prognosis of hypertensive individuals, the medications may also have a negative impact on someone with renal disease, further exacerbating fluid and electrolyte balance issues (Gropper & Smith, 2013, p. 460). However, results are mixed. Some studies have shown that RAAS blockers may actually have renoprotective properties. Their research demonstrated a positive correlation with RAAS blockers and patients who were younger, who had advanced CKD, were diagnosed with diabetes mellitus (DM), and had proteinuria. On the other hand, other studies have not seen a significant positive correlation between using RAAS blockers and an improved prognosis for elderly patients (Pradeep et al., 2015, p. 2483).

Oral Hydration Challenges in Nursing Homes

With the decreased ability to biologically regulate hydration status due to various age related factors, maintaining hydration in nursing home residents is a challenge. This

is evidenced by research showing that nearly 70% of nursing home residence experience dehydration or impending dehydration (Marra et al., 2015, p. 832).

Janet Mentes, a prominent researcher in geriatric hydration, defines what is considered dehydration and groups patients into categories depending on their reason for dehydration. She evaluates the patients by measuring their urine specific gravity, comparing urine color, issuing a bioelectrical impedance analysis test, and noting their meal intake records. She also clarifies that "An episode of dehydration was defined as a hospitalization for dehydration, an on-site administration of intravenous fluids for dehydration, or a blood urea nitrogen/creatinine ratio greater than 25:1" (2006, p. 14). With these stricter guidelines and a small sample size of 35 participants, she concludes that dehydration was a considerable problem with only 30% of residents.

Despite the small sample size, she is able to identify a basis for some underlying issues associated with dehydration. She divided her participants into four categories: those who can drink, those who cannot drink, those who will not drink, and end of life. In the category of those who can drink, there are two subgroups. The first are those who are independent. They are able to feed themselves without any physical or psychological limitations. Though they may not feel thirsty, they choose to drink at meals or at other times. There are also those who can drink but forget; these patients have psychological barriers such as dementia or Alzheimer's. Since they no longer are as sensitive to the thirst sensation, they tend to forget to drink fluids (p. 16).

In the category of those who cannot drink, there is the dysphagic subgroup and the physically dependent subgroup. Dysphagic patients have swallowing difficulties and aspiration precautions, which requires supervised eating and drinking times in the nursing

homes. Otherwise physically dependent patients may have a disease like Parkinson's or paralysis and also require supervised eating. Those who will not drink are found in the third category (p. 16).

A person who will not drink may be a sipper, or someone who never consumed many fluids before living in the nursing home and chooses to continue that trend. Someone who will not drink may also fear incontinence, either because they will not reach a bathroom in time or because they cannot use the bathroom without assistance (p. 16).

The final category consists of those who are at the end of life, for which Mentes recommends an advance directive regarding fluid intake. Depending on the patient situation, the specifications of the advance directive can affect hydration status (p. 16).

Highest Risk Factors in Dehydrated Nursing Home Residents

In her research Mentes (2006) is also able to identify those who are most at risk for dehydration. Overall, those in the category of will not drink who fear incontinence had the highest urine specific gravity. Interestingly they also had the highest cognitive functioning according to the Cognitive Performance Scale (CPS). The CPS has 7 levels of cognitive functioning, with 0 being no impairment and 6 being severe impairment. In her study, those who feared incontinence scored a 0, indicating no cognitive impairment (p. 15, 18). It is possible that these patients are able to better maintain their cognitive function due to the ability to eat water containing foods, unlike those with physical limitations.

Though those who feared incontinence had on average the highest urine specific gravity, dysphagic patients have the greatest risk of dehydration. The participants in this

group had the second highest urine specific gravity and scored the highest on the CPS. Their average score was a 4.1, which indicates more than moderate cognitive impairment (Mentes, 2006, p. 18). Because of the difficulty dysphagic patients have when consuming foods and beverages and the quantity of dysphagic patients in nursing homes to supervise while eating it is no surprise that they are the most at risk.

Implications of Dehydration in the Elderly

The most common results of dehydration in elderly patients are confusion, general weakness, and an altered drug metabolism (Brown, 2014, p. 461-2**)**. As researchers have pointed out, dehydration and declining cognitive function is a particularly vicious cycle (Hooper, 2016, p. 776). When a patient becomes dehydrated, they become cognitively impaired. As cognitive impairment increases, they also become more likely to forget or refuse fluid intake. However, there are also other implications regarding dehydration in the elderly. Research in relation to delirium statistics has shown that those who suffer from delirium have higher morbidity and mortality rates and longer hospital stays compared with their non-delirious peers (Sandberg, Gustafson, Brannstrom, & Bucht, 1999, 1305). In 2011, researchers found that there were over 100,000 patients admitted to the hospital with a primary diagnosis of dehydration who were over the age of 65. On average, their dehydration episode resulted in 3.6 days in a hospital, amounting to approximately six billion dollars in hospital costs. Dehydration is not only physically costly, but it is also economically costly (Marra et al., 2015, p. 828).

Solutions

Since dehydration episodes are financially costly and may cause irreparable damage to the patient, practitioners and long term care facilitators must first and foremost

find a way to prevent dehydration before it occurs. One issue researchers have noted is that there is little to no effective screening for dehydration in nursing homes and long term care facilities. Since there are already routine checks evaluating malnutrition and pressure ulcers, it is surprising that there are few routine dehydration assessments (Oates & Price, 2017, p. 13).

Testing blood serum osmolality is clinically the most accurate way to screen for dehydration. However these tests are not commonly ordered due to their cost and the specific laboratory equipment required to run the test. Other methods such as using a bioelectrical impedance analysis and testing urine specific gravity are cheaper alternative options, yet nursing homes may not have regular access to that kind of equipment. Additionally, symptoms such as urine color, urine volume, dry mouth, and the thirst sensation which are normally present in healthy adults during dehydration are not accurate dehydration indicators for the elderly (Campbell, 2016, p. 25-6).

Naomi Campbell, a researcher in the United Kingdom as developed a screening tool called the 'reliance on carer to drink' which she refers to as ROC. This tool evaluates and categorizes patients using three methods. First, it links the risk of dehydration to the amount of support needed to swallow. Second, it assesses how much assistance or supervision is required during feeding and drinking periods. Third, it determines how much prompting a patient may need to drink. Campbell believes that the ROC will determine who is at the greatest risk of dehydration so caretakers can make proactive decisions regarding client hydration strategies (2016, p. 24).

Some researchers suggest there is an under-emphasis on behavioral factors in correlation with hydration. Behavioral factors include fear of incontinence, the inability

to consume fluids independently, a lack of available staff to encourage and monitor fluid intake, and inaccessibility to fluids, particularly desired fluids. In response to the lack of solutions involving behavioral factors and hydration, Sandra Simmons conducted a study that explored methods for encouraging nursing home residents to increase their fluid intake over time. In her study, she encouraged increased fluid intake in three phases. During the first 16 weeks, patients were verbally prompted to drink fluid 4 times a day in between meals. The following 8 weeks patients were encouraged to drink fluids 8 times a day between meals. During the final 8 weeks patients were not only prompted 8 times a day, but they were also provided the beverage of their choice. The resulting data showed that 81% of participants increased their fluid intake between phase 1 and 2, and 71% of participants continued to increase their fluid intake during phase 3 when drink preferences were accommodated (2016, p. 926-30).

Conclusion

Dehydration, though a serious problem in nursing homes and long term care facility residents, is frequently overlooked during routine care. While primary diseases take precedence over dehydration, neglecting hydration status causes the accumulation of other problems that in turn can further exacerbate disease symptoms. Though a urinary tract infection or a respiratory infection may be relatively easy for a healthy adult to overcome, the recovery process for elderly people is much more difficult and more costly. Cognitive functioning, which is heavily influenced by hydration status, is especially key in maintaining the quality of life and recovering from disease or injury. If practitioners implement better screening methods and utilize more effective hydrating

methods, they could decrease the number of dehydration episodes and reduce the costs associated with dehydration.

References

Arora, P., Golzy, M., Patel, N., Quigg, R., Carter, R. L., & Lohr, J. W. (2015). Renin-Angiotensin-Aldosterone System Blockers in Elderly Adults with Chronic Kidney Disease without Diabetes Mellitus or Proteinuria. *Journal Of The American Geriatrics Society*, *63*(12), 2478-2484. doi:10.1111/jgs.13842

Centers for Disease Control and Prevention. (2014). *National Diabetes Statistics Report: Estimates of Diabetes and Its Burden in the United States*. Atlanta, GA: U.S. Department of Health and Human Services.

Centers for Disease Control and Prevention. (2016). *High Blood Pressure Facts*. Retrieved from https://www.cdc.gov/bloodpressure/facts.htm

Gropper, S. S., & Smith, J. L. (2013). *Advanced Nutrition and Human Metabolism*. Belmont: Wadsworth.

Hooper, L. (2016). Why, Oh Why, Are So Many Older Adults Not Drinking Enough Fluid? *Journal of the Academy of Nutrition and Dietetics, 116*(5), 774-8. http://dx.doi.org/10.1016/j.jand.2016.01.006

Lowth, D. M. (2016). Chronic kidney disease. *Practice Nurse*, *46*(8), 28-32.

Mahan, L. K., Escott-Stump, S., & Raymond, J. L. (2012). *Krause's Food and the Nutrition Care Process*. St. Louis: Elsevier.

Marra, M. V., Simmons, S. F., Shotwell, M. S., Hudson, A., Hollingsworth, E. K., Long, E., & ... Silver, H. J. (2016). Research: Elevated Serum Osmolality and Total Water Deficit Indicate Impaired Hydration Status in Residents of Long-Term Care Facilities Regardless of Low or High Body Mass Index. *Journal of the*

Academy of Nutrition and Dietetics, 116828-836.e2. doi:10.1016/j.jand.2015.12.011

Mentes, J. (2006). A typology of oral hydration problems exhibited by frail nursing home residents. *Journal Of Gerontological Nursing*, *32*(1), 13-21.

Sandberg, O., Gustafson, Y., Brannstrom, B., & Bucht, G. (1999). Clinical profile of delirium in older patients. *Journal Of The American Geriatrics Society*, *47*(11), 1300-1306.