Dehydration and Fluid Maintenance in the Long-Term Care Setting

CLINICAL PRACTICE GUIDELINE

PALTmed
POST-ACUTE AND LONG-TERM CARE MEDICAL ASSOCIATION

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Preface

This clinical practice guideline (CPG) has been developed under a project conducted by the Post-Acute and Long-Term Care Medical Association (PALTmed), the national professional organization rep-resenting medical directors, attending physicians, and other practitioners who care for patients in the long-term care setting. This is one of a number of guidelines undertaken as part of the association's mission to improve the quality of care delivered to patients in these settings.

Original guidelines are developed by interdisciplinary workgroups, using a process that combines evidence and consensus-based approaches. Workgroups include practitioners and others involved in patient care in long-term care facilities. Beginning with a general guideline developed by an agency, association, or organization such as the Agency for Healthcare Research and Quality (AHRQ), pertinent articles and information, and a draft outline, each group works to make a concise, usable guideline that is tailored to the long-term care setting. Because scientific research in the long-term care population is limited, many recommendations are based on the expert opinion of practitioners in the field. A bibliography is provided for individuals who desire more detailed information.

Guideline revisions are completed under the direction of the Clinical Practice Guideline Steering Committee. The committee incorporates information published in peer-reviewed journals after the original guidelines appeared as well as comments and recommendations not only from experts in the field addressed by the guideline but also from "hands-on" long-term care practitioners and staff.

Purpose

PALTmed seeks to develop and revise guidelines that focus on specific concerns and common problems in the long-term care setting. Although AHRQ and other agencies, organizations, and associations have developed a number of guidelines for conditions that occur in elderly and chronically ill indi-viduals, many of these guidelines limit or omit considerations that are unique to the long-term care population.

PALTmed guidelines emphasize key care processes and are organized for ready incorporation into facility-specific policies and procedures to guide staff and practitioner practices and performance. They are meant to be used in a manner appropriate to the population and practice of a particular facility. Guideline implementation will be affected by resources available in the facility, including staffing, and will require the involvement of all those in the facility who have a role in patient care.

Audience

This guideline is intended for the members of the interdisciplinary team in long-term care facilities, including the medical director, director of nursing, practitioners, nursing staff, consultant pharmacist, and other professionals such as therapists, social workers, dietitians, and nursing assistants who care for residents of long-term care facilities.

PALTmed CPGs include many functions and tasks related to recognizing, clarifying, managing, and monitoring various conditions and situations. But the guidelines only sometimes specify who should do these tasks. For example, many disciplines including nursing assistants, licensed nurses, dieti-cians, and social workers may make and document observations (e.g., that someone does not sleep at night, is more withdrawn, or has a change in usual eating patterns). But only some of them ma

may be qualified to determine the significance of those observations (for example, what is causing the sleeplessness or change in eating patterns). In contrast, physicians and nurse practitioners may not be present to make observations, but are trained to analyze the significance and causes of symptoms. Thus, each facility should ensure that tasks are done correctly and by appropriate interdisciplinary team members. It is important for observers to make and document findings effectively, but they should get appropriate support for interpreting the findings when this is not within the scope of their training or practice.

Assumptions

Guidelines in the long-term care setting should be consistent with fundamental goals of desirable long-term care practice. Operationally, this requirement means that the nursing facility care team systematically addresses (1) each individual's risk factors for a number of diseases and conditions and (2) the adverse consequences of the diseases and conditions on the patient's functioning and quality of life.

However, when nursing facility patients are at or near the end of life, care goals will shift from functional improvement or physical stability to palliation or comfort care. PALTmed guidelines address this transition and provide suggestions for appropriate modification of the patient's care plan.

Long-term care facilities care for a variety of individuals, including younger patients with chronic diseases and disabilities, short-stay patients needing postacute care, and very old and frail individuals suffering from multiple comorbidities. When a workup or treatment is suggested, it is crucial to consider if such a step is appropriate for a specific individual. A workup may not be indicated if the patient has a terminal or end-stage condition, if it would not change the management course, if the burden of the workup is greater than the potential benefit, or if the patient or his or her proxy would refuse treatment. It is important to carefully document in the patient's medical record the reasons for decisions not to treat or perform a workup or for choosing one treatment approach over another.

How to Use These Guidelines

Each guideline includes a narrative portion that covers definition, recognition, assessment, treatment, and monitoring of the condition being addressed. "Recognition" means identifying the presence of a risk or condition. "Assessment" means clarifying the nature and causes of a condition or situation and identifying its impact on the individual. "Treatment" means selecting and providing appropriate interventions for that individual. "Monitoring" means reviewing the course of a condition or situation as the basis for deciding to continue, change, or stop interventions.

Each guideline also includes an algorithm that summarizes the steps involved in addressing the condition. In the algorithm, rectangles signify points where action is to be taken; diamonds indicate points where a decision must be made.

Terminology

We recognize that people who reside in long-term care facilities are "residents". However, we have used the term "patient(s)" throughout these guidelines because we are addressing individuals within the context of treating a medical condition. In addition, these guidelines apply substantially to individuals who come to long-term care facilities for short-term care. When referring to pharmaceutical products, we have avoided the use of brand names and refer to classes of drugs whenever possible.

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GLOSSARY

Hypernatremic dehydration. A condition in which electrolyte losses are disproportionately smaller than water losses.

Intravascular volume depletion. A state of vascular instability characterized by the net loss of total body sodium and a reduction in intravascular volume.

Osmolality. A measure of the osmoles of solute per kilogram of solvent (Osm/kg).

Osmolarity. A measure of solute concentration, defined as the number of osmoles of solute per liter of solution (Osm/L).

Tonicity. The osmotic pressure of a solution; it is modulated by the number of effective osmoles that are restricted to one side of the cell membrane because of permeability characteristics.

Dehydration and Fluid Maintenance
in the Long-Term Care Setting

Definition

Dehydration refers to a complex condition resulting in a loss of total body water—with or without salt—at a rate greater than the body can replace it.

Dehydration is one form of fluid/electrolyte imbalance. A fluid/electrolyte imbalance is defined as an insufficiency or excess of either water or electrolytes (sodium and potassium) in certain body areas.

See **Glossary** for definitions of other terms used throughout this guideline.

INTRODUCTION

Because no universally accepted definition of dehydration exists, several parameters have been used to suspect or define this condition. However, all of these definitions have limitations.[1] This confusion over the definition of dehydration results in confusion about the clinical diagnosis of dehydration in the long-term care (LTC) setting. Dehydration may be inappropriately used as a nonspecific generic term referring to derangement in any fluid compartment. Practitioners often use the term dehydration when they mean intravascular volume depletion.[2] Furthermore, a diagnosis of dehydration may be inappropriately used as a medical reason for hospitalization when the diagnosis has resulted primarily from social considerations.[3] At hospital admission, many older people who are diagnosed as dehydrated do not meet any accepted diagnostic criteria.[4]

Basic Physiology of Body Water

Water accounts for about 60% of body weight in an average adult; this figure varies with the degree of adiposity. Water is distributed in virtual compartments in the body and moves between compartments by osmosis or by biochemical pumps. Total body water (TBW) is about 42 L in a 70-kg person, or approximately 600 mL/kg. TBW is divided into intracellular fluids (two thirds of TBW, or approximately 400 mL/kg) and extracellular fluids (one third of TBW, or approximately 200 mL/kg). About 75% of the extracellular fluid is distributed between cells (approximately 150 mL/kg), and about 25% is found in the intravascular space (also known as blood circulation, approximately 50 mL/kg).[5]

The principal regulator of extracellular water is sodium, because of active transport of sodium into the extracellular space, whereas the principal regulator of the larger intracellular compartment is the effective osmolarity of the extracellular fluid. The body maintains essentially equal tonicity across both compartments by osmosis.

Intravascular volume depletion can lead to hypotension, compensatory tachycardia, decreased tissue perfusion, and shock. To prevent these complications, the human body has homeostatic mechanisms to protect intravascular volume, primarily via the sodium pump, which transfers water into the intravascular space from both the extracellular and intracellular compartments.

Body Regulation of Fluids and Fluid Balance in Aging Adults

The youthful human body is quite forgiving, but as we age, we lose organ-specific function and even small changes in fluid volume can adversely affect homeostasis. In some patients, as little as 500 mL of fluid can make the difference between fluid deficit and fluid overload.

Regulation of thirst involves multiple sites in the brain. The day-to-day regulation of fluid intake is mainly controlled by osmoreceptors (specialized areas of the brain that are sensitive to the concentration of electrolytes in the circulation).

With aging, TBW in both the extracellular and intracellular compartments declines. The percentage of water as a component of body mass also declines, from 60% in younger patients to 50% in older people.[6] Aging kidneys concentrate urine less efficiently, which may lead to excessive fluid or the loss of retention of free water. Physiological stress such as urosepsis or pneumonia may accelerate fluid loss.

Older people have a reduced capacity to adapt to loss of sodium and extracellular fluid volume. Aging kidneys also can lose the ability to respond to normal or elevated levels of circulating antidiuretic hormone and to produce dilute urine (i.e., excrete free water in the urine). The frail elderly often experience diminished thirst sensation as osmoreceptor sensitivity decreases. Some older people describe minimal thirst despite significant fluid deficits. Even after drinking free water, it takes longer for older people to correct fluid/electrolyte imbalances.[7] These factors increase the risk for hyponatremia and its subsequent risks for disorientation, functional decline, and (in severe cases) seizures, coma, and death.

Some frail elders have trouble swallowing efficiently, which further reduces their ability to drink adequate amounts of fluid each day. Common neurological conditions (e.g., dementia, Parkinson's disease, stroke), which may be exacerbated by medication use, and pharyngeal defects also may affect swallowing in the frail elderly. Additionally, residents of LTC facilities may decrease their fluid intake because of difficulty in toileting; for fear of urinary incontinence; or because of depression, pain, or delirium.

Diuretic use and mobility disorders are other factors that may place LTC residents at higher risk for dehydration. Morgan et al found that in response to heat and exercise, older men lost more intracellular fluid and less interstitial fluid than did younger men in an attempt to maintain intravascular volume.[8] As a result of these diverse factors, older people are especially vulnerable to the impact of dehydration and other fluid/electrolyte imbalances and their complications.

Prevalence of Dehydration

The prevalence of dehydration in the LTC setting is unknown. Because the definitions of dehydration vary, published studies do not offer a reliable way to identify how frequently this condition occurs.

Using the Minimum Data Set (MDS 2.0) definitions, the point prevalence of dehydration in Missouri LTC facilities was 1.4%, compared with 1.2% in Iceland and 0.8% in Ontario.[9] In a small sample of institutionalized older men followed (with serial lab work) for 6 months, 40% had at least one serum osmolality value greater than 295 mOsm/kg and 20% had a serum osmolality value greater than 300 mOsm/kg, but none had a concurrent serum sodium concentration greater than 146 mEq/L or a blood urea nitrogen to creatinine (BUN:Cr) ratio greater than 25:1, (A ratio of greater than 20:1 or 25:1 is variably used to define intravascular volume depletion). BUN:Cr ratios ranged from 12:1 to 34:1 over the 6 months; 20% of subjects demonstrated elevated ratios consistently throughout the study without clinical evidence of dehydration. Only two patients had elevations of both serum osmolality and serum sodium, although both had a normal BUN:Cr ratio. Only 60% of the men maintained a normal serum sodium level throughout the 6 months; however, none of the men had clinical signs of dehydration at any time. These data suggest that in clinically stable LTC patients, frequent elevations of serum osmolality can occur without overt clinical evidence of dehydration or an accompanying elevated sodium or BUN:Cr ratio.[10]

In community-dwelling older adults, the prevalence of dehydration ranged from 0.5% for hypotonic hypovolemia (defined as plasma osmolarity less than 285 mOsm/L with orthostatic hypotension) to 60% for hypertonic hypovolemia (defined as plasma sodium greater than 145 mEq/L, BUN:Cr ratio greater than 20:1, or osmolarity greater than 295 mOsm/L). In this observational study, elevated osmolarity and BUN:Cr ratio were associated with chronic disease and functional impairment.[11]

Miller et al, in a study of older community-dwelling African Americans (mean age 79.7 years), found an elevated BUN:Cr ratio in 10% (the laboratory's published upper limit of normal of 18 was used as the highest normal value) and an elevated sodium level in only 1%.[12] The Duke Established Populations for Epidemiologic Studies of the Elderly surveys reported that approximately 50% of older adults had elevated plasma tonicity.[11] The most likely reason for this increased prevalence of hypertonicity (i.e., hyperosmolarity) is the high prevalence of elevated glucose levels in older persons.[13]

Dehydration is reported more often in hospitalized persons. In one study, 7.8% of hospitalized older persons were identified as having a diagnosis of dehydration.[14] In another study,[4] for subjects with a clinical diagnosis of dehydration, 83% had a calculated serum osmolarity of less than 295 mOsm/L, 32% had a BUN:Cr ratio of less than 20:1, and 89% had a serum sodium of less than 145 mEq/L. Using a loose criterion for volume status, 68% of subjects had laboratory values suggesting intravascular volume depletion. This suggests that very few subjects had criteria for intracellular volume depletion and that clinicians were using the term dehydration synonymously with intravascular volume depletion. Because of the use of loose criteria for the diagnosis and the use of dehydration as a nonspecific term, at least a third of the diagnoses of either dehydration or intravascular volume depletion were incorrect on the basis of laboratory data.

Consequences of Dehydration

Dehydration can have severe consequences. Dehydration may predispose frail older residents of LTC facilities to develop complications including falls, functional decline, increasing or new confusion and disorientation, and orthostasis.

The diagnosis of dehydration is associated with an increase in hospital morbidity and mortality.[14-18] Patients with a diagnosis of dehydration admitted to an acute-care hospital had a mortality rate of

30%. Hypernatremic dehydration (defined as a serum sodium level greater than 145 mEq/L and BUN greater than 25 mg/dL with serum creatinine below 3 mg/dL) was present in 2.9%. Patients aged over 85 years had a higher prevalence of dehydration (5.3%) than did patients aged under 65 years (1.6%). A higher mortality (33%) was observed in those with serum sodium levels of 151 to 153 mEq/L, and the highest mortality rate (71%) was observed in those with serum sodium levels of more than 154 mEq/L.[19] Dehydration has been shown to double hospital mortality in patients admitted with stroke,[20] double the risk of pressure ulcers,[21] and increase the length of hospital stay in patients with community-acquired pneumonia.[22]

Dehydration is both an effect and a cause of disability. For example, dehydration may contribute to disability because of weakness associated with electrolyte imbalance. In a 1991 study, Medicare beneficiaries hospitalized with dehydration were identified as having various underlying conditions: 28% were diagnosed with pneumonia and influenza, 25% with urinary tract infections, and 10% with gastroenteritis.[23] These findings suggest that dehydration may be associated with many diseases that cause catastrophic or progressive disability (e.g., cancer, diabetes, hip fracture, pneumonia, stroke). Dehydration increases the likelihood that patients who have suffered a stroke will require rehospitalization.[24]

Functional or cognitive decline or death in patients who have dehydration may reflect the underlying disease state rather than a primary disorder of water regulation. In an acute-care geriatric unit, 11% of subjects developed elevated plasma osmolarity of 320 mOsm/L or greater in the 6 months after admission. In-hospital mortality was higher in hyperosmolar subjects (35.4%) than in non-hyperosmolar subjects (16.7%). Diabetes was the most common cause of hyperosmolarity; patients also developed hyperosmolar states in association with cardiovascular or renal disease, cognitive impairment, or infection. Impaired functional mobility, but not the degree of hyperosmolarity, was a risk factor for in-hospital mortality.[25]

Other studies have confirmed that hyperosmolality is either a marker for, or a cause of, increased mortality in frail elderly patients.[17] In that study, which was conducted in a geriatric continuing care unit, patients with the highest osmolality (greater than 308 mOsm/kg) had both significantly reduced short-term survival and increased mortality at 2 years. However, there was no correlation between age and plasma osmolality.

The clinical approach to fluid therapy depends in part on the underlying causes of dehydration. Severe consequences may result when the clinical approach to fluid therapy is driven solely by a diagnosis of dehydration. For example, the choice between replenishing the extravascular or intravascular fluid compartments may lead to either inadequate fluid replacement or overhydration. In hemodynamically compromised patients with orthostatic hypotension and oliguria, it is crucial to replace fluid loss with isotonic saline until hemodynamic stabilization (i.e., pulse and blood pressure reflecting adequate circulating blood volume) is achieved.[26] On the other hand, overzealous rehydration and improper monitoring can result in congestive heart failure, hyponatremia with altered mental status, and death in older people.[27]

Challenges in Recognizing and Managing Dehydration

Effectively preventing, recognizing, and managing dehydration in the LTC setting is challenging for many reasons. The diagnosis is difficult because no reliable physical signs or symptoms of dehydration exist. In addition, hydration risks may arise as a consequence of the attempt to treat another problem or symptom. For example, modifying fluid or diet consistency to try to manage swallowing

abnormalities may lead to inadequate fluid intake; treating hypertension or heart failure with diuretics may lead to excessive fluid loss. At times, disease processes can undermine attempts to maintain fluid balance; for example, conditions present at the end of life may cause fluid and electrolyte imbalance or may affect fluid intake by impairing consciousness or making it too painful to eat or drink. In such cases, dehydration is most likely a consequence—not a cause—of the dying process.

Personal beliefs and misconceptions can influence the understanding and management of dehydration. Some people believe that hydration is necessary even in end-of-life situations; others believe, mistakenly, that dehydration is de facto evidence of poor and negligent care.

Dehydration is designated a sentinel quality of care indicator in the LTC setting. The diagnosis of dehydration in a patient hospitalized from a LTC or home-care setting may be assumed to reflect a failure in the quality of care delivered[28]; this very limited use of the diagnosis, however, does not address the spectrum of disease or the opportunities to intervene sooner rather than later. Even with exemplary care provided by an interdisciplinary team, a patient may refuse fluids or be unable to orally consume sufficient fluid to maintain adequate hydration. LTC facilities are required, however, to input the International Classification of Diseases (ICD-9) diagnosis coding for dehydration or volume depletion in the MDS if a patient has been diagnosed as such, (e.g., on hospital or emergency department admission). This may result in dehydration being identified as a sentinel event regardless of whether any clinical or diagnostic criteria are present or were present at the time of the diagnosis. Additionally, LTC facilities are expected to try to treat residents whose hydration status is at risk before transferring them elsewhere for additional care. For these and other reasons, dehydration is an unreliable quality of care indicator.[29]

Outcomes That May Be Expected From Implementation of This Clinical Practice Guideline

The following outcomes may be expected from implementation of this clinical practice guideline:

- Appropriate hydration targeted to underlying causes;
- Earlier identification of fluid imbalances and their complications;
- Enhanced patient quality of life;
- Facilitation of patient-centered care goals;
- Greater individualization of care;
- Increased discussions with families about expectations, and the inability to prevent certain outcomes, in patients with dementia and dysphagia;
- Improved monitoring and treatment protocols;
- Improved staff education and awareness of this complex problem;
- More appropriate resource utilization;
- Reduction in potentially avoidable hospitalizations;
- Reduction in the number of inappropriate diagnoses of dehydration; and
- Stable outcomes in cognition, falls, fatigue, function, and pressure ulcers and reductions in comorbid illnesses as a result of appropriate treatment of dehydration.

RECOGNITION

STEP 1

Does the patient have risk factors or predisposing conditions for dehydration? Assess the patient for risk factors and other indicators that may predispose to dehydration (Tables 1 and 2).

The body may lose water via the kidneys, skin, lungs, and gastrointestinal tract. The kidney is the main controller of body water. Normal kidneys filter about 150 L of fluid per day, only about 1% (1.5 L) of which is excreted as urine. Cutaneous water loss through sweating is a major mechanism for regulating body temperature. Sweating dissipates a substantial amount of body heat.

The body generally loses around 500 mL of water per day via the skin (cutaneous route) but can lose substantially more in the presence of burns, fever, high environmental temperatures, increased metabolism, or increased physical activity. A relatively small amount of water (around 200 mL per day) can be lost through respiration. This loss is affected primarily by ventilatory volume and relative environmental humidity. A large amount of water passes through the intestines each day, most of which is recovered by the colon. Ordinarily, about 100 mL per day is lost through feces. However, gastrointestinal water loss can increase significantly in the presence of diarrhea, vomiting, or other gastrointestinal conditions, which may in turn cause severe dehydration.

In a 6-month study of 35 LTC residents (mean age 82 years), Mentes et al found that dehydration was most common in those who had difficulty drinking, who feared urinary incontinence,[30] and who were dysphagic or physically dependent on assistance with eating or drinking. The study was limited in that it used an elevated BUN:Cr ratio or hospitalization as diagnostic criteria for dehydration.

TABLE 1
Risk Factors for Dehydration

Altered thirst	◆ Focal central nervous system lesions ◆ Hypodipsia of aging ◆ Medications (see Table 8)
Decreased cognitive function	◆ Delirium ◆ Dementia ◆ Depression ◆ Sedation ◆ Psychosis/paranoia
Increased fluid losses	◆ Diarrhea ◆ Fever ◆ Vomiting ◆ Diuretics ◆ Specialty air-flow mattresses
Limitations in oral intake	◆ Dysphagia ◆ Fear of urinary incontinence ◆ Inadequate tube feeding volume ◆ Limited mobility ◆ Modified fluid consistency (thickened liquids) ◆ Need for feeding assistance

TABLE 2

Potential Indicators Suggesting Increased Risk of or Need for Clinical Evaluation for Dehydration

Risk Factors

- Acute illness
- Decrease in fluid intake (<75% of food or fluid consumed at meals)
- Dementia/depression
- Dietary restrictions (e.g., thickened liquids)
- Dysphagia
- Excessive sweating, fever
- Medications (e.g., ACE inhibitors, diuretics, laxatives, lithium, phenytoin toxicity)
- Patient on nothing-by-mouth status (e.g., gastrointestinal preparation)
- Vomiting/nausea/diarrhea/anorexia

Signs and Symptoms

- Change in ADLs
- Change in mental status
- Constipation
- Decreased urine output
- Dizziness/faintness
- Postural hypotension
- Tachycardia
- Weakness
- Weight loss (3–5 lb in short time)

ACE: angiotensin-converting enzyme; ADLs: activities of daily living

No single clinical assessment tool should be relied on to identify dehydration. Such tools are of limited utility because there are no specific physical findings for dehydration and the condition may present with diverse, nonspecific symptoms. For example, Mentes developed a dehydration risk appraisal checklist consisting of three personal characteristics,[10] significant health conditions, six medication factors, eight questions regarding intake, and four laboratory abnormalities (available at http://rgp.toronto.on.ca/torontobestpractice/Dehydrationriskappraisalchecklist.pdf; accessed April 17, 2009); however, because this checklist would identify most residents of LTC facilities as being at risk for dehydration, its utility as a screening tool in the LTC setting is limited.

Signs and symptoms of dehydration and volume depletion in older people may be vague, deceptive, or absent. Thus, clinical changes, such as changes in function, oral fluid intake, and urine output, must be evaluated in at-risk elderly patients. Early detection of acute illness, followed by objective estimation of hydration status, is key to preventing significant dehydration. Nursing assistants should be trained to systematically observe patients for early signs and symptoms of acute illness.[31] In the absence of definitive signs, staff and practitioners must recognize and report risk factors for dehydration such as diarrhea, use of diuretics, and adverse medication effects on eating and drinking.

Information in the MDS may help to identify risk factors for dehydration; however, the practitioner should not overly rely on the MDS, or wait to complete it, to suspect dehydration.

STEP 2

Is the patient dehydrated? Maintain a high level of suspicion for dehydration in the LTC setting.

Medical history. Review existing diagnoses, conditions, medications, and current restrictions on fluid and food intake or consistency that may cause or contribute to dehydration. Additional information from the patient or family and from other members of the interdisciplinary team, if indicated, may also be helpful. Also assess environmental and other factors that may be causing or contributing to the problem or risk.

Although diverse categories of information may help to establish the suspicion of dehydration, each has its limits. Clinical signs of extravascular volume deficit are often misleading. Physical examination may suggest the presence of dehydration, but staff and practitioners should not rely solely on any clinical measures or signs and symptoms to indicate that dehydration is present, nor should they rely on the absence of such signs and symptoms to rule out the presence of dehydration.

Body weight. Body weight may be helpful or may have limited value in the recognition of dehydration. A rapid decrease in body weight (e.g., several pounds over several days) may indicate significant fluid loss, but this possibility needs to be confirmed by clinical examination and diagnostic testing. If a patient's prior stable body weight is known, the acute loss of 3% or more of body weight may suggest dehydration; however, this approach may be more useful and practical in athletes and younger persons than in older people. Weight fluctuations caused by disease or medication effects may be misleading; in older persons, such fluctuations may be as much as 3 to 4 pounds, which is within the standard error of measurement on most scales.

Physical examination. Focus the physical examination on a general assessment of the patient, including vital signs, and seek to determine whether the patient has signs of intravascular volume depletion (e.g., hypotension, tachycardia); volume overload (e.g., edema, rales); elevated body temperature; or moist or dry axillae and mucous membranes.

Some physical findings can help to identify patients with dehydration, but no physical findings are diagnostic. The most helpful physical findings are severe postural dizziness (such that the patient cannot assume an upright position) or a postural pulse difference (increase from lying down to sitting or standing) of 30 beats per minute or more.[4] Supine hypotension and tachycardia are frequently absent in extravascular fluid loss and the finding of mild postural dizziness has no proven diagnostic value. Despite its common use as an indicator of dehydration, orthostasis has many other causes (e.g., autonomic dysfunction) and is fairly common in the older population.

Other physical signs of possible dehydration are often confusing, particularly in older adults. Dry mucous membranes may be misleading as many elderly people are mouth breathers or are taking anticholinergic or other medications that affect salivation. The finding of sunken eyes is not very helpful (sensitivity of 62%). The presence of a dry axilla supports (but by itself does not prove) the diagnosis of dehydration, whereas a moist mucous membrane and a tongue without furrows suggest a lower likelihood that dehydration is present. In adults, capillary refill time and poor skin turgor have no proven diagnostic value.[32] Chassagne et al identified decreased skin turgor (subclavian and forearm), dry axillae, orthostasis, recent changes in consciousness (delirium), and tachycardia as factors associated with dehydration in the LTC setting. However, none of these factors were reliably or consistently diagnostic.[18]

Urine color. Urine color is not a useful indicator of hydration status. An eight-level urine color scale is a reasonable index of hydration in athletic and industrial settings or in research studies involving healthy people[33]; in sick people, however, studies suggest only a weak relationship between urine color and urine output. No correlation has been observed between urine color and body weight change, plasma osmolality, or urine specific gravity.[34] Urine specific gravity is poorly correlated with serum biochemical measures of hydration status.[35]

Intake and output measurement. Intake and output measurement should be relied upon sparingly because the value of such monitoring is limited in the LTC setting. Intake monitoring may be more accurate in tube-fed patients and in those whose intake can be reliably documented because they are completely dependent on staff for fluid intake. Output often is difficult to document accurately.[36] In some cases, however, body weight, intake, and output may help to corroborate data from other sources.[27] Measuring what the patient is willing to take in during the course of a day may be helpful for describing a patient's response to fluids that are offered.

ASSESSMENT

The diagnosis of dehydration cannot be made on clinical grounds alone. Ultimately, the diagnosis is biochemical (established via laboratory tests). Because of potential complications, the diagnosis should be confirmed or excluded as quickly as possible.

STEP 3

Is a medical workup appropriate? An appropriate workup can help to identify or characterize a current dehydration or fluid/electrolyte imbalance or define the risks for developing these problems. A physical examination and laboratory tests can help to confirm the diagnosis and guide patient management.

Patients should be categorized according to their level of risk for dehydration or fluid/electrolyte imbalance and given a workup appropriate for their risk level. It is not necessary to complete a workup on every patient, and not all of those who would benefit from a workup require comprehensive testing. It is important to define the level of workup that is appropriate for each patient and to consider non-interventional approaches.

If a patient has a living will or other advance directive specifying that no artificial hydration or nutrition be administered, practitioners should discuss with the patient and others involved in the patient's welfare whether a workup should proceed. This also applies to patients receiving comfort care, those receiving palliative care, or those in a hospice program. If a medical workup is not performed, the reasons for this decision should be clearly documented in the patient's medical record. In many cases, facilities attempt futile and medically ineffective interventions in an attempt to demonstrate proactivity. (See PALTmed's clinical practice guideline *Palliative Care in the Long-Term Care Setting*.[a])

STEP 4

Perform appropriate laboratory evaluation. Given the limited value of clinical signs in diagnosing and managing dehydration, laboratory evaluation is the clinical gold standard for both diagnosing

[a] Post-Acute and Long-Term Care Medical Association. Palliative Care in the Long-Term Care Setting. Clinical Practice Guideline. Columbia, MD.

dehydration and monitoring hydration. If dehydration is suspected and a workup is indicated (or not limited by patient or family choice), at a minimum, obtain values for BUN, serum bicarbonate, creatinine, glucose, sodium, calcium, and potassium.

In addition, either directly measure or calculate serum osmolarity. This is a very sensitive measurement that rises in dehydration with a percentage body weight loss of as little as 1%.[37] During dehydration caused by insufficient fluid intake, both plasma sodium and osmolarity are typically significantly elevated. Serum osmolarity can be either measured directly or estimated by use of one of the following formulas:

Osmolarity = 2 X (serum sodium + serum potassium) + (BUN/2.8) + (serum glucose/18)

Osmolarity = 2 X (serum sodium) + (BUN/2.8) + (serum glucose/18)

Although the diagnosis of extracellular volume depletion can be suspected from the patient's medical history and a careful physical examination, a definitive diagnosis requires laboratory data. To diagnose intracellular volume depletion, either obtain a serum sodium level (e.g., as part of a basic metabolic profile) or calculate serum osmolarity (tonicity).[2]

A hyperosmolar state (greater than 295 mOsm/L) and hypernatremia (greater than 145 mEq/L) usually occur only with dehydration caused by a deficit in free water. On the other hand, hyponatremia may be associated with isotonic, hypertonic, or hypotonic osmolarity. Isotonic hyponatremia (pseudohyponatremia) may occur with hypertriglyceridemia or hyperproteinemia. The syndrome of inappropriate antidiuretic hormone secretion (SIADH) is the most common cause of isotonic hyponatremia in older adults.[38] The diagnostic criteria for SIADH are in Table 3. Hypertonic hyponatremia may occur in the presence of severe hyperglycemia or hypertonic infusions. These conditions should be excluded by appropriate blood chemistry testing.

TABLE 3

Diagnostic Criteria for the Syndrome of Inappropriate Antidiuretic Hormone Secretion

Essential

- No diuretics
- No signs of volume depletion, no edema
- Normal thyroid function, normal adrenal function
- Plasma osmolality less than 275 mOsm/kg
- Urinary osmolality greater than 100 mOsm/kg
- Urinary sodium greater than 40 mmol/L

Supplemental

- BUN less than 10 mg/dL
- Correction of hyponatremia with fluid restriction
- Elevated AVP levels
- Failure to correct hyponatremia with 0.9% saline
- Fractional excretion of sodium greater than 1%
- Uric acid less than 4 mg/dL

AVP: arginine vasopressin; BUN: blood urea nitrogen.

Adapted from Ellison DH, Berl T. Clinical practice. The syndrome of inappropriate antidiuresis. N Engl J Med. 2007; 356(20): 2064-2072.

Hypotonic hyponatremia is a more common clinical presentation. It is caused by conditions in which salt and water losses occur together. (An assessment and treatment algorithm for distinguishing hypotonic hyponatremia from hypertonic hypernatremia is found in Appendix 1.) Hypotonic hyponatremia is usually associated with a decrease in intravascular volume and signs of hypotension and tachycardia. This type of dehydration typically occurs in medical conditions that produce gastrointestinal water loss, renal water loss, or adrenal insufficiency; it may also occur with the use of diuretics. A careful physical examination and additional laboratory testing should be performed to differentiate these conditions. If the physical assessment identifies a normal volume status (e.g., normal vital signs, no edema, moist axillae), consider central nervous system malfunction, potassium loss, renal disease, SIADH, or water intoxication.

Hypervolemic hyponatremia, in which the blood sodium level is lowered as a result of hypervolemia (expansion of the blood volume), is most often seen in congestive heart failure, liver disease, and renal disease. Neither isovolemic nor hypervolemic hyponatremia is considered to be a form of dehydration.

The BUN:Cr ratio should be used cautiously to assess hydration status (Table 4). This ratio has been used to estimate the adequacy of intravascular volume; although the ratio may be useful in children or healthy adults, it is less useful in older adults because of the high incidence of renal disease in this population. When both BUN and creatinine are elevated, the same ratio is more likely to be caused by renal disease than by dehydration. BUN may be markedly elevated in relation to creatinine in the setting of even a minor gastrointestinal bleed. BUN may be low as a result of low protein intake or liver disease and serum creatinine may be low because of muscle wasting, thus limiting the utility of this measurement in determining hydration status. However, a disproportionate increase in BUN relative to creatinine (e.g., a 45:1 ratio compared with a previous 20:1 ratio) may indicate intravascular volume depletion regardless of whether underlying renal disease or these other factors are present.

TABLE 4
Pitfalls in Using the Blood Urea Nitrogen to Creatinine Ratio to Diagnose Dehydration

Ratio	Interaction	Cause
>15:1	BUN increased, Cr normal	◆ Pre-renal azotemia (dehydration) ◆ Post-renal azotemia (obstruction)
8-15:1	BUN increased, Cr increased	◆ Renal azotemia
5-8:1	BUN decreased, Cr normal	◆ Liver disease ◆ Low protein intake (starvation) ◆ Overhydration
5-8:1	BUN normal, creatinine decreased	◆ Muscle-wasting disease (e.g., cachexia, sarcopenia)

Adapted from Lyman JL. Blood urea nitrogen and creatinine. Emergency Medicine Clinics of North America. 1986;4(2):223-33.

The frequency of the diagnosis of dehydration depends heavily on the criteria used for the diagnosis. Using only a BUN:Cr ratio greater than 20:1 produces extremely high prevalence rates of dehydration. In an emergency department study, 48% of subjects aged over 75 were diagnosed as dehydrated on admission. However, less than 3% of these subjects had a serum sodium level greater

than 145 mEq/L, a percentage close to that seen in other published reports.[39] When unadjusted for other contributing causes, a BUN:Cr ratio should not be used as the sole criterion for diagnosing dehydration.

STEP 5

Determine the causes of and factors contributing to dehydration. If the patient is dehydrated, it is important to try to identify the underlying causes of the dehydration. These efforts should be continued until a cause is identified or it is determined either that a cause cannot be identified or that identifying a cause would not change the treatment or ultimate outcome.

In most cases, dehydration is caused by disease or by the effects of medication and not primarily by inadequate access to water. Some causes of dehydration are iatrogenic; this may be due in part to the fact that practitioners tend to underestimate older adults' fluid requirements.[40] Moderate dehydration may also occur in patients undergoing bowel preparation prior to a colonoscopy.[41]

Information about the causes of dehydration should be well documented in the patient's medical record. Often, several categories of causes will occur simultaneously (e.g., increased loss of salt and water caused by diuretics, leading to decreased fluid intake as a result of lethargy and confusion). Typically, several causes must be addressed simultaneously to correct the problem. Appendix 2 describes the physical symptoms, lab results, and suggested treatments for a loss of water vs. a loss of water and sodium.

STEP 6

Establish the severity of the patient's hydration status and summarize findings. The severity of dehydration drives the clinical approach to fluid therapy and helps to determine the urgency of treatment.

Using the information obtained in Steps 2 through 4, summarize the nature, severity, and causes of the patient's dehydration or risk for dehydration and assess the impact of this condition or risk on the patient's functioning and quality of life (Table 5). The diagnoses or conditions that are contributing to the patient's current fluid/electrolyte status should be identified. Alternatively, explain why these diagnoses or conditions could not be established or why finding them would likely not change either the approach or the ultimate outcome.

TABLE 5

Examples of Documentation Related to Varieties of Fluid/Electrolyte Imbalance

- Case 1: The patient has an elevated BUN:Cr ratio because of a recent increase in dosages of loop diuretics and ACE inhibitors (ACE inhibitors are poorly tolerated in the face of dehydration), which was needed because the patient's underlying CHF worsened. The degree of impairment is currently mild. Patient's food and fluid intake is variable. Goal is to continue diuresis while trying to minimize fluid/electrolyte imbalance. May need to adjust diuretics depending on symptoms and results.
- Case 2: The patient has a sodium of 128 mEq/L and a mildly elevated BUN:Cr ratio despite not taking diuretics. So far, she has not shown symptoms related to hyponatremia, such as lethargy and confusion. Edema has increased and she has some dyspnea at rest. Probable cause is worsening heart failure. The patient will be placed on fluid restriction, a diuretic will be prescribed, and follow-up laboratory and weight monitoring will be ordered.
- Case 3: The patient recently had pneumonia and was treated with antibiotics, which caused diarrhea. Subsequently, she ate and drank poorly. Her last sodium was 152 mEq/L and her BUN:Cr ratio has increased progressively over the past 2 weeks. Her daily diuretic dose will be held for a few days, oral fluid intake will be encouraged, and lab work will be rechecked to ensure that her fluid/electrolyte balance improves.
- Case 4: This patient with end-stage lung disease has been declining recently. He and his family have chosen palliative care. He is not eating or drinking well. The last laboratory tests done before the palliative care option was selected showed worsening hydration status. However, he is expected to continue to decline. Continuing to obtain blood work or trying to adjust fluids based on test results will not change the anticipated outcome. Instead, he will be offered food and fluids as tolerated.

CHF: congestive heart failure

TREATMENT

STEP 7

Establish treatment goals. Treatment goals for the patient with dehydration may range from complete resolution of fluid/electrolyte imbalances to palliation.

The ethical issues surrounding the withholding of medical treatment of dehydration (e.g., tube feeding, intravenous or oral fluid administration) have been extensively discussed elsewhere[42-45] and remain an area of intense debate. The use of artificial hydration may be appropriate when it can readily correct dehydration or its underlying causes and thereby restore the patient to a desired level of function or quality of life; however, long-term artificially administered hydration may be inappropriate for ethical reasons in some circumstances (e.g., for a patient with severe end-stage dementia and a very poor prognosis). Patients with certain end-stage conditions (e.g., heart, lung, liver, and kidney diseases) may experience multisystem failures that prevent effective electrolyte balance even when fluids are provided artificially.

Recommendations to use or not to use potential treatment options (taking into consideration the patient's overall state of health, preferences, and any existing advance directives) should be discussed with the patient and the patient's family or surrogate decision maker, and those discussions should be documented in the patient's medical record. When parenteral fluids are medically indicated, the goals of therapy and the risks and benefits of the recommended procedures should be reviewed and documented in the medical record.

When the patient's condition is such that artificial hydration or nutrition is not medically indicated, it is critical—especially in the absence of a clear advance directive—that the practitioner document this. Dehydration at the end of life is part of the dying process and is not painful. Purposeful dehydration during end-of-life palliation offers certain advantages (Table 6).[46]

The number of good-quality studies is insufficient to make any recommendations for practice with regard to the use of medically assisted hydration in palliative care patients.[47] One study involving palliative care patients found that sedation and myoclonus (involuntary muscle contractions) were improved more in the dehydration treatment group (n=28) than in the placebo group (n=23). Another study found that dehydration was significantly higher in the non-hydration group, but that some fluid retention symptoms (pleural effusion, peripheral edema, ascites) were significantly higher in the group receiving hydration (n=59) than in the non-hydration group (n=167). Three other studies did not show significant differences in outcomes between the two groups.

TABLE 6

Benefits of Purposeful Dehydration During End-of Life Palliation

Physiologic Action	Result
Reduced level of consciousness	Less anxiety and fear of death
Release of endorphin-like substances	Increased levels of comfort
Diminished pulmonary secretions	Less cough, congestion, and need for suctioning
Decreased levels of body fluids	Reduced edema and ascites, making respirations easier
Decreased production of gastrointestinal fluids	Reduced nausea, vomiting, bloating, and regurgitation of gastric contents
Decreased urine output	Less need for a urinal or bedpan

Adapted from: Fordyce M. Dehydration near the end of life. Annals of Long Term Care 2000; 8(5): 29-33.

STEP 8

Address dehydration and manage related issues. When treatment is indicated, the key to correcting dehydration is to correct water and sodium deficits. The choice of therapy depends on the patient's clinical condition, including complications that influence the type and urgency of rehydration efforts. Water can be replaced orally, enterally, intravenously, or subcutaneously (hypodermoclysis). Additional factors that influence treatment include patient goals and wishes; facility capabilities, policies, procedures; and the availability of experienced providers and staff to administer treatments and monitor the patient's status.

In patients who have mild or moderate dehydration who are no more than minimally unstable (i.e., patients who can drink and who do not have significant mental or physical compromise as a result of the fluid loss), oral hydration generally should work well. Packaged oral rehydration solutions can be very effective for the relatively stable patient with fluid/electrolyte imbalance who is able to drink, even if fluid loss via the gastrointestinal tract continues.

The type of oral replacement fluid should be selected on the basis of the source of the water loss. For example, water loss caused by extreme physical exertion, which includes loss of sodium and potassium, may require solutions containing supplemental sugars, salt, and potassium. Balanced solutions of water and electrolytes (i.e., sports drinks) may be more effective for fluid replacement under these circumstances. Water loss caused by diarrhea or vomiting likewise may require replacement of sodium and potassium. Oral rehydration formulas, which have been widely used in children, may be effective for fluid replacement in older adults.[48]

Not all patients, however, will respond to increased oral intake of fluids. The interdisciplinary team must determine what interventions are most likely to achieve the best outcome for each patient, all things considered. Moderate dehydration without hemodynamic compromise (i.e., with adequate blood pressure, pulse, and kidney output) may be treated with subcutaneous or intravenous fluid replacement. In hemodynamically compromised patients with orthostatic hypotension and oliguria (i.e., severe dehydration), volume replacement with isotonic saline (saline provided in the facility or, more commonly, through acute hospitalization) until hemodynamic stabilization occurs is recommended.[4] For additional clinical insights that may be helpful in treating dehydration, see Appendix 3.

Subcutaneous Fluid Administration

Consider subcutaneous fluid administration (hypodermoclysis) for patients with mild to moderate dehydration who are not able to take adequate oral fluids and who are hemodynamically stable. Table 7 presents guidelines for the use of hypodermoclysis.

Hypodermoclysis can be used as an alternative method of delivering fluids for patients who are stable and for whom intravenous access is not desired or is difficult to establish. Isotonic or hypotonic solutions can be administered at a rate of 1 mL/min through needles inserted into the subcutaneous tissue of the abdomen or anterior or lateral thigh. Up to 1500 mL can be delivered through a single site and 3000 mL through two sites in 24 hours.[49] Normal saline (0.9%), half-normal saline (0.45%), 5% dextrose in water (D5W), and Ringer's solution have been used for subcutaneous infusion to treat dehydration.

The use of hypodermoclysis may facilitate the management of rehydration in patients with dementia. In a study of 60 LTC patients with dementia and mild to moderate dehydration, 80% of subjects receiving intravenous fluids were agitated, compared with 37% of subjects receiving subcutaneous fluids. No differences were found between the treatment groups in the amount of fluid administered or in the improvement of dehydration parameters.

TABLE 7

Guidelines for the Use of Hypodermoclysis

Advantages

- Avoidance of hospitalization
- Ease of use
- Less risk of infection, phlebitis, etc.
- Lower risk of fluid overload than intravenous hydration therapy
- No need for intravenous-certified nurse

Disadvantages

- A limited volume of fluid can be administered
- Pain or edema may occur at the injection site

Contraindications

- Coagulation disorders or anticoagulant therapy, severe hemodynamic instability (e.g., severe dehydration, shock)

Guidelines

- Use isotonic or hypotonic solution. Never use hypertonic solution, which may cause hypotension and shock
- Up to 3000 mL of fluid may be given in a 24-h period through two subcutaneous lines
- The average rate of fluid infusion is 60–80 mL/h; fluid may be infused at rates of up to 125 mL/h for up to 8 h or 250 mL/h for up to 4 h
- Change infusion site after giving 1500 mL of fluid
- The anterior or lateral thigh is the preferred infusion site; other sites that may be used are the medial aspect of the thigh, abdominal wall, subclavicular regions of the thorax, and inter- and subscapular areas of the back
- Consider using recombinant human hyaluronidase as an adjuvant to increase fluid absorption and dispersion

Technique

- Verify the practitioner order
- Explain the procedure to and obtain consent if necessary from the patient, family, or surrogate decision maker
- Prepare the site by cleaning it with antiseptic solution
- Insert 18–21-gauge needles, attached to the infusion tubing, at a 30°–45° angle into subcutaneous tissue at one or two separate sites
- Apply dressing to infusion sites
- If desired, inject hyaluronidase into the tubing
- Monitor the infusion. Stop the infusion if pain, redness, burning, bruising, or excessive edema develops

Hypodermoclysis can produce tissue slough or abscess formation at the site of administration. The risk of these adverse effects may be reduced by administering adjuvant recombinant human hyaluronidase to increase fluid absorption and dispersion. In rare cases, hypodermoclysis may result in overhydration.

Subcutaneous infusion is not appropriate for patients who:

- Have existing or imminent shock or hypotension;
- Have severe dehydration requiring hospitalization;
- Have severe heart failure, acute myocardial infarction, generalized edema, or a skin infection or allergic skin diseases at the injection site; or
- Need administration of a parenteral medication.

Intravenous Fluid Replacement

The appropriateness of intravenous fluid replacement depends on the clinical diagnosis, the urgency of the situation, and the patient's ability to take oral or enteral fluids. In patients who have severe dehydration or are hemodynamically unstable, hospitalization is generally indicated, provided that hospitalization has not been declined in advance directives or by the patient's or family's express wishes.

For older patients who present with dehydration caused by free water deficits (e.g., related to febrile illness) and who are hemodynamically stable, fluid replacement can be achieved with 5% dextrose in water. Fluid can be replaced at a rate of 25% to 30% of the estimated total free water deficit (FWD) per day; the exact rate of replacement will depend on the acuity of the loss. FWD can be calculated by use of the following[50].

FWD (in L) = Dosing factor x weight (kg) x [(serum Na/140)-1]

(Dosing factor = 0.6 if male and 0.5 if female)

For example, if a patient's sodium is 154 mEq/L and body weight* is 50kg, then:

FWD = (0.5 x 50kg) x [(154/140) – 1] = 3 L

*body weight refers to baseline body weight before fluid loss occurred

The utility of this formula is limited by the fact that the patient's baseline weight before becoming dehydrated must be known and used in the calculation.

In patients with intravascular volume depletion who are hemodynamically unstable and have significant volume loss (e.g., severe vomiting or diarrhea), isotonic saline should generally be used until the patient is hemodynamically stable.

General Support for Patients with Dehydration

Offer general support to all patients with dehydration. Such support may include administration of food and fluids, additional assistance as needed with activities of daily living (e.g., if dehydration has caused lethargy or delirium), and management of medical conditions that may be causing or complicating the patient's dehydration. The underlying cause or causes contributing to the dehydration should be identified.

The staff and practitioner, with the input of the consultant pharmacist, should review the patient's medication regimen and identify and adjust medication doses that are causing or exacerbating hydration problems or exacerbating complications of dehydration such as lethargy and confusion (Table 8). For example, it may not be enough to give intravenous fluids to a patient who is continuing to lose excessive salt and water while remaining on diuretics or angiotensin-converting enzyme inhibitors. Consider stopping or reducing the doses of such medications until dehydration and its complications have resolved.

- ***Treat comorbid conditions***

  Identify treatments for the patient's diagnoses or conditions that are causing or contributing to dehydration or electrolyte imbalance or causing or contributing to complications; for example:
  - Treat pneumonia or a urinary tract infection causing symptoms of lethargy, fever, and confusion that have resulted in decreased fluid intake and increased fluid losses.
  - Treat congestive heart failure or chronic obstructive pulmonary disease exacerbations with lethargy caused by hypoxemia or hypoperfusion leading to decreased fluid intake.

- Stop or reduce the dose of an antibiotic that has caused diarrhea, which has in turn led to excessive fluid loss.
- Review existing diet orders and remove any nonessential fluid and salt restrictions.[51]
- Review altered-consistency diets. Such diets are sometimes ordered because of a swallowing abnormality or symptom, but the risk of aspiration may be outweighed by the risk of weight loss and dehydration. Altered-consistency diets (e.g., thickened liquids) may be unpalatable and may lead to decreased patient intake.[52]

A member of the interdisciplinary team should discuss the diagnosis and treatment recommendations with the patient and his or her family or surrogate decision maker.

TABLE 8
Examples of Medications That May Increase Dehydration Risk

Medication or Class	Mechanism
ACE inhibitors, ARBs	Prevent activation of pathway for compensatory sodium retention
Caffeine formulations	Direct diuresis
Diuretics	Direct diuresis
Laxatives	Direct water loss
Lithium	Direct diuresis
Theophylline preparations	Direct diuresis
Tricyclic antidepressants, SSRIs	Hyponatremia, SIADH
Vitamin D/calcium formulations	Hypercalcemia

ACE: angiotensin-converting enzyme; ARB: angiotensin II receptor blocker; SIADH: syndrome of inappropriate antidiuretic hormone secretion; SSRI: selective serotonin reuptake inhibitor.

MONITORING

STEP 9

Monitor the patient's overall condition and responses to intervention. Monitoring is important both while correcting a patient's dehydration or other fluid/electrolyte imbalance (Table 9) and as a measure to prevent dehydration in susceptible persons. Ongoing monitoring of patients' fluid/electrolyte status should include frequent checking for signs and symptoms that may indicate dehydration (see Steps 1 and 2). Closely monitor the patient's general status (e.g., level of consciousness, vital signs) as well as specific organ systems (e.g., heart, lungs, kidneys, skin) that can be affected by dehydration or by rehydration efforts. Also monitor the patient's emotional responses to treatment. The frequency of monitoring will depend on the severity of the fluid/electrolyte imbalance, the patient's physical and mental function, and the route and rate of rehydration. During the first several days of treatment, monitoring may need to occur several times daily. Subsequently, as the situation improves, it may be reasonable to reduce the frequency of monitoring.

Monitor and adjust fluid administration to try to avoid adverse consequences. Adjust the rate and concentration of fluids using the formulas in Step 8, combined with assessments of the patient's physical and mental function.

TABLE 9
Monitoring Acute Rehydration

- Check vital signs, mental and physical function, and alertness.
- Assess adequacy of fluid intake or infusion, being alert for signs of overhydration (e.g., progressive edema, rapid weight gain [greater than or equal to 0.5 kg (1 lb) per day]).
- Repeat pertinent laboratory tests as clinically indicated to ensure that fluid/electrolyte balance is being restored effectively. When checking laboratory values, focus on trends. For example, a gradually increasing or decreasing sodium level deserves close attention and repeat monitoring, whereas a sodium level that is high- or low-normal but stable may be less clinically significant.
- Check patients receiving intravenous fluids at least once per shift for the first 24 to 48 h. In general, notify the practitioners of the patient's status within the first 24 h; specifically, call to report evidence of swelling, weight gain, shortness of breath, or change in lung sounds such as rales, (listen to lung sounds each shift).
- Nursing assistants and other direct caregivers who spend the most time with patients day-to-day are well positioned to monitor function, alertness, and food and fluid intake. They should be trained to identify and report signs and symptoms of possible hydration problems, especially in patients with known risk factors for dehydration (e.g., diuretics, fever, hot weather, vomiting, diarrhea). All staff should assist at-risk patients with fluid intake and offer additional fluids when appropriate.
- Continue to monitor the course of illnesses that are causing or contributing to dehydration or related complications. When possible, adjust or stop medications and treatments that are adversely affecting appetite, fluid intake, fluid/electrolyte balance, level of consciousness, or thirst, at least until hydration status is stable or improving and the risk of further imbalance is minimized. If the underlying causes are not readily treatable, document why the problem cannot be treated or why the treatment is not working.
- Modify the care plan as indicated to reflect decisions to change or discontinue hydration-related interventions or any other treatments. For example, sometimes patients or families will request a trial of artificial hydration until they see that it is not changing the course of illness or improving quality of life, and will then agree to shift to palliative care.

Excessive free-water replacement or overly rapid rehydration can be harmful. Water intoxication (i.e., electrolyte imbalance, primarily severe hyponatremia, caused by excessive or overly rapid consumption or administration of hypotonic fluid) can cause dangerous or fatal disturbances of brain function. In addition, overly rapid rehydration can cause heart failure, especially in patients with impaired cardiac or renal function.[28]

STEP 10

Improve the facility's approach to preventing and managing dehydration. Facilities can make reasonable efforts to prevent dehydration and to recognize and manage it appropriately. First and foremost, each facility should establish a systematic approach based on consistent adherence to the processes and practices discussed in this guideline. This includes recognizing risk factors; focusing on meeting patients' personal needs; and learning to identify, document, and report findings that could represent fluid/electrolyte imbalance.

In addition, it is important to discuss and try to dispel widely held myths about hydration and dehydration, including those related to the potential benefits and drawbacks of hydration in palliative and end-of-life situations. Family and community involvement in care can also help to focus on the basics of nutrition and hydration and to address related misconceptions. (See PALTmed's clinical practice guideline *Altered Nutritional Status*.[b])

Through its quality assurance processes, the facility should review the care and management of patients who become dehydrated, including those who are hospitalized or rehydrated in the facility (see Appendix 4).

[b] Post-Acute and Long-Term Care Medical Association. Altered Nutritional Status. Clinical Practice Guideline. Columbia, MD.

Prevention of Dehydration

Make reasonable efforts to try to prevent dehydration. A reasonable strategy is to combine individualized encouragement of fluids with efforts to address individual risk factors, to the extent possible, and individualized monitoring as indicated. Table 10 suggests some strategies for preventing dehydration that are based on expert consensus.

Maintaining fluid balance is complex and involves the coordinated activity of many organ systems. Dehydration cannot be prevented solely by giving plenty of fluids, no matter how frequently. Because the body normally excretes fluids consumed in excess of basic needs, it is not feasible to exceed current fluid needs to try to prevent future dehydration. There is no good evidence to support trying to target a uniform amount of hydration (e.g., 1500 mL/d) for everyone, regardless of individual need or tolerance. Few data exist to support the assertion that dehydration can be prevented in older adults by either close observation or interventional trials. It is overly simplistic to blame caregivers when patients become dehydrated and to suggest that better routine hydration and monitoring can prevent all incidents of dehydration.[53]

TABLE 10
Strategies for Trying to Prevent Dehydration

- Communicate clinical changes effectively
- Emphasize the importance of hydration daily
- Encourage family involvement in increasing fluid intake
- Increase awareness of factors responsible for dehydration (e.g., fever, hot weather, diarrhea, vomiting)
- Increase early identification of acute illness
- Offer fluids regularly
- Provide preferred beverages
- Provide straws and cups that residents can use for drinking
- Report promptly decreased fluid intake and possible signs or symptoms of dehydration
- Try to manage urinary incontinence so that patients will be less likely to avoid fluids
- Use a hydration cart
- Use frozen juice bars
- Use swallowing exercises and use cues before administering thickened liquids

The precise daily requirement for water in older adults is controversial. Recommendations include 1 mL per kilocalorie of food intake;[54] 30 mL per kilogram of body weight;[55] or the sum of 100 mL/kg fluid for the first 10 kilograms of actual body weight, 50 mL/kg fluid for the next 10 kilograms of actual body weight, and 15 mL/kg fluid for the remaining kilograms of actual body weight.[56] The first of these recommendations assumes normal caloric intake; the second depends on the person's body weight, which may not be normal; and the third attempts to adjust for current body weight. All three recommendations include water derived from all sources, including water from food. For example, about 75% of a standard serving of most enteral feeding products is free water.

When water derived from food is subtracted, the most general recommendation for fluid intake (including free water) is 1500 to 2000 mL/d.[32] Most older persons do not consume these recommended daily amounts of fluids. Direct observations of institutionalized adults indicate a total fluid intake, including fluids derived from meals, of 1783±545 mL.[57] Most community-dwelling adults consume only about 1000 mL of fluids per day[58,59]; institutionalized older persons may consume less.

Patients with conditions limiting their ability to feel thirsty or to seek or drink fluids need help

from others to get those fluids. Additionally, some patients may require adaptive feeding equipment to enable them to function at their highest level of self-performance with eating and drinking; the interdisciplinary team should ensure that the patient is evaluated for need and provided with such equipment if necessary. In the event that a patient is either partly or fully dependent on staff for feeding, staff must be available to assist them and must know that those patients need assistance with intake. Additionally, staff must routinely monitor all LTC patients' intakes of foods and fluids. Noted changes in intake should be promptly investigated, including attempting to determine the cause of the change.

Despite almost universal agreement that fluids need to be aggressively offered to older persons, remarkably few studies have been published on the prevention of dehydration. In some LTC patients, verbal prompting and offering a preferred beverage can increase fluid intake. In one study, patients who were more cognitively impaired responded to verbal prompting, whereas those who were less cognitively impaired responded to the offering of a preferred beverage. Substantial staff time was required to conduct the intervention over a 3-day period.[60]

The effects of systematic oral prompts to drink fluids and of offering a choice of beverages were tested in a three-phase study of 63 incontinent LTC patients.[60] In phase 1 (16 weeks), participants were prompted to drink fluids once every 2 hours four times a day during incontinence and mobility care sessions. In phase 2 (8 weeks), participants were prompted twice every 2 hours (at the beginning and end of each incontinence and mobility care session) four times a day. Research staff offered water and a variety of juices before offering coffee or tea (given the participants' incontinence problems and the diuretic properties of coffee and tea). Finally, in phase 3 (8 weeks), in addition to receiving eight verbal prompts per day, participants were also offered a variety of beverages from which to choose (e.g., apple, cranberry, grape, orange, and tomato juices; water; and milk) and research staff complied with participants' expressed beverage preferences.

In response to the verbal prompts, about 80% of subjects increased their average daily fluid intake. An additional 20% of subjects increased their average daily fluid intake only when their preferred beverage was offered. In one third of subjects the average increase in fluid intake was less than 5 oz. Another third of subjects increased their fluid intake from 5 to 20 oz per day. One quarter of subjects showed a decrease in their fluid intake. Significant improvements in serum osmolality and BUN:Cr ratio were observed only in patients whose oral intake increased by more than 5 oz per day. The improvement in average daily fluid intake correlated directly with cognitive status, with the greatest benefit occurring in patients with a higher level of cognitive function.

Early detection of acute illness followed by objective evaluation is key to the prevention of significant dehydration. It is also important for the interdisciplinary team to detect as early as possible changes from baseline that suggest the possible onset of acute illness.

SUMMARY

Dehydration and other fluid/electrolyte imbalances are common problems in the LTC population. Prevention is often—though not always—possible. Many current beliefs about hydration and the causes of dehydration—including the belief that inadequate care is a frequent cause—are unfounded. In end-of-life or palliative situations, it may not be possible to attain or maintain adequate fluid and electrolyte balance. Dehydration usually results from underlying illnesses or from iatrogenic factors, and only sometimes reflects problems with the quality of care.

Prevention and management of dehydration require a systematic approach that incorporates an understanding of the mechanism, severity, and causes of the hydration problem and of the patient's overall condition and stability. By implementing the steps described in this guideline, LTC facilities can meet patient needs and demonstrate to the public and to regulatory agencies that they can effectively prevent and manage many cases of dehydration.

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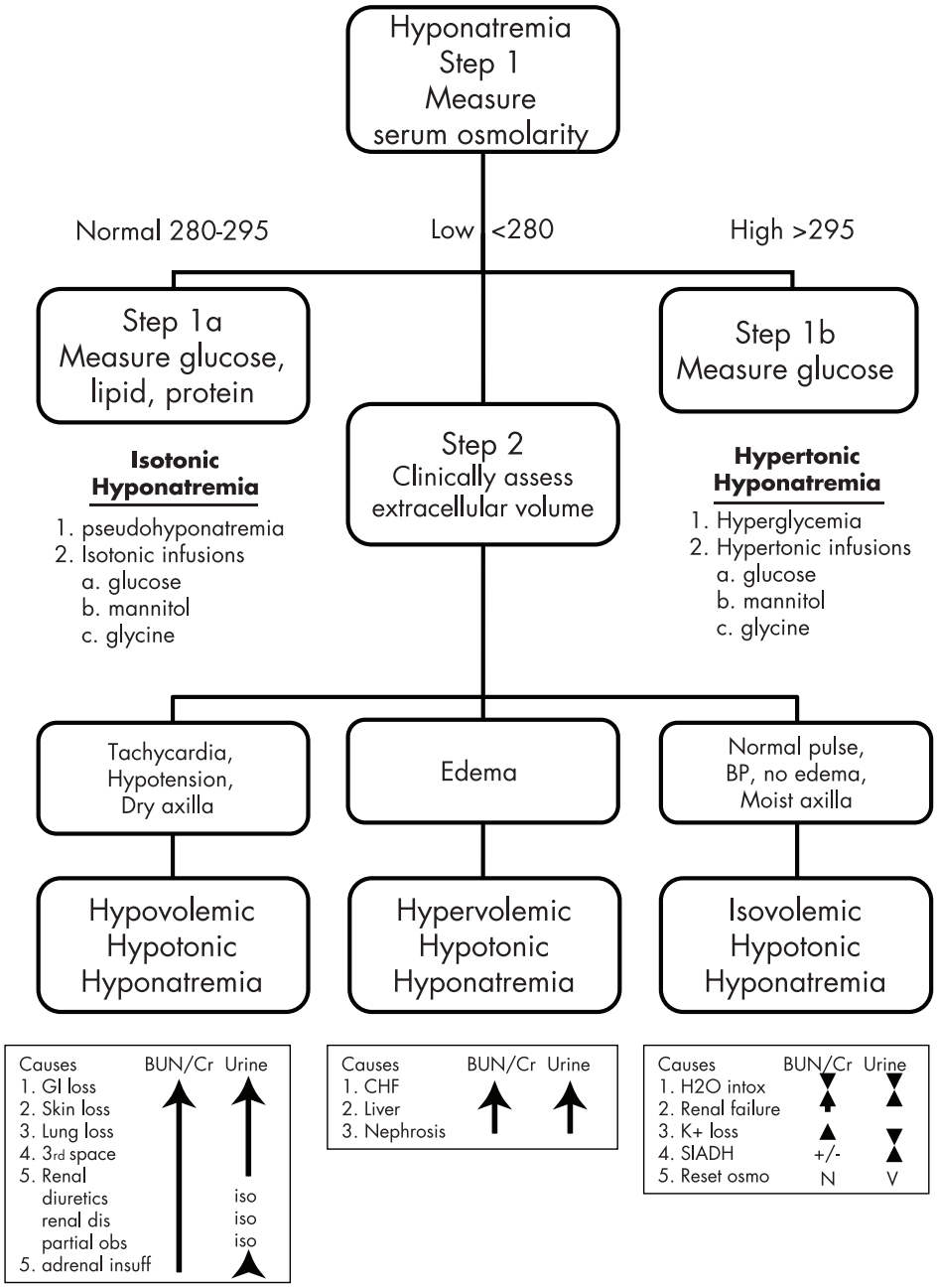
APPENDIX 1

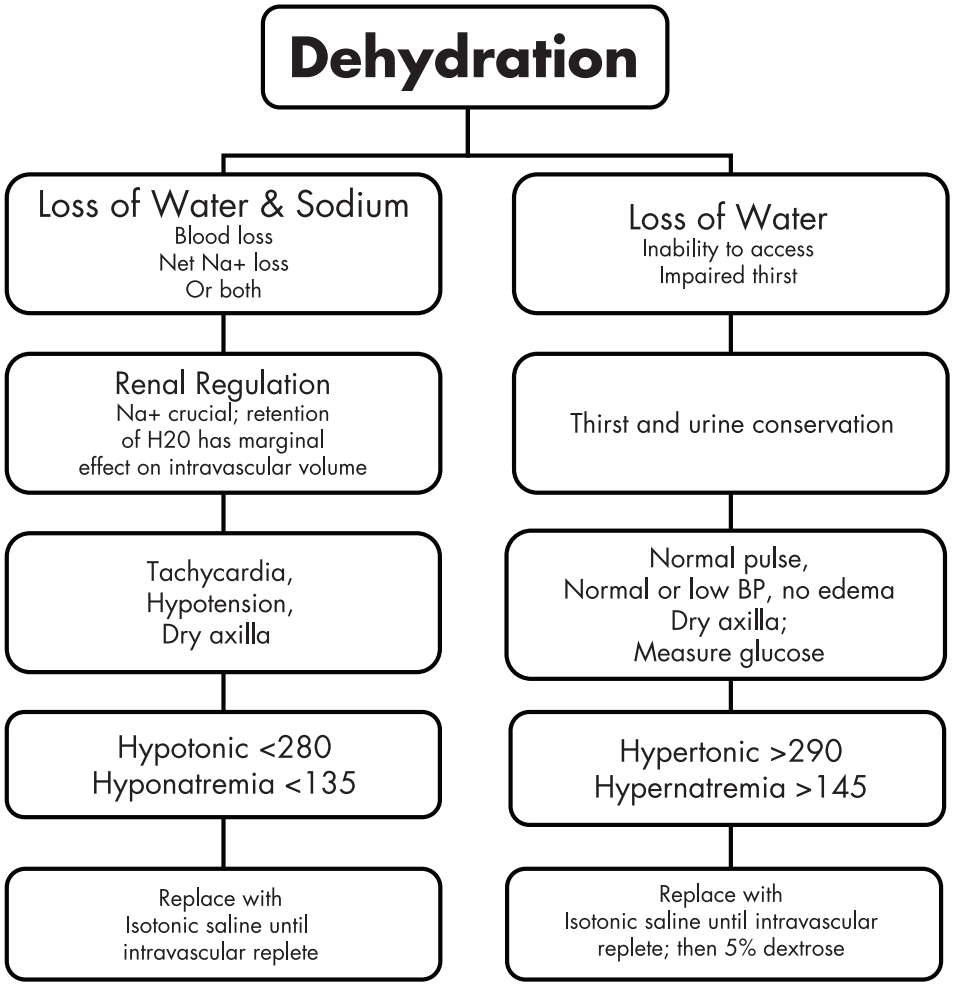
Assessment and Treatment Algorithm for Hyponatremia



Adapted from Narin RG, et al. Amer J Med 1982;72:496

APPENDIX 2

Differentiating and Treating Loss of Water vs. Loss of Water and Sodium



Causes	BUN/Cr	Urine
1. GI loss	↑	↑
2. Skin loss	↑	↑
3. Lung loss	↑	↑
4. 3rd space	↑	↑
5. Renal	↑	↑
diuretics	↑	iso
renal dis	↑	iso
partial obs	↑	iso
5. adrenal insuff	↑	↓

Adapted from: Narins RG, Jones ER, Stom MC, et al. Diagnostic strategies in disorders of fluid, electrolyte and acid-base homeostasis. Am J Med 1982; 72(3): 496-520.

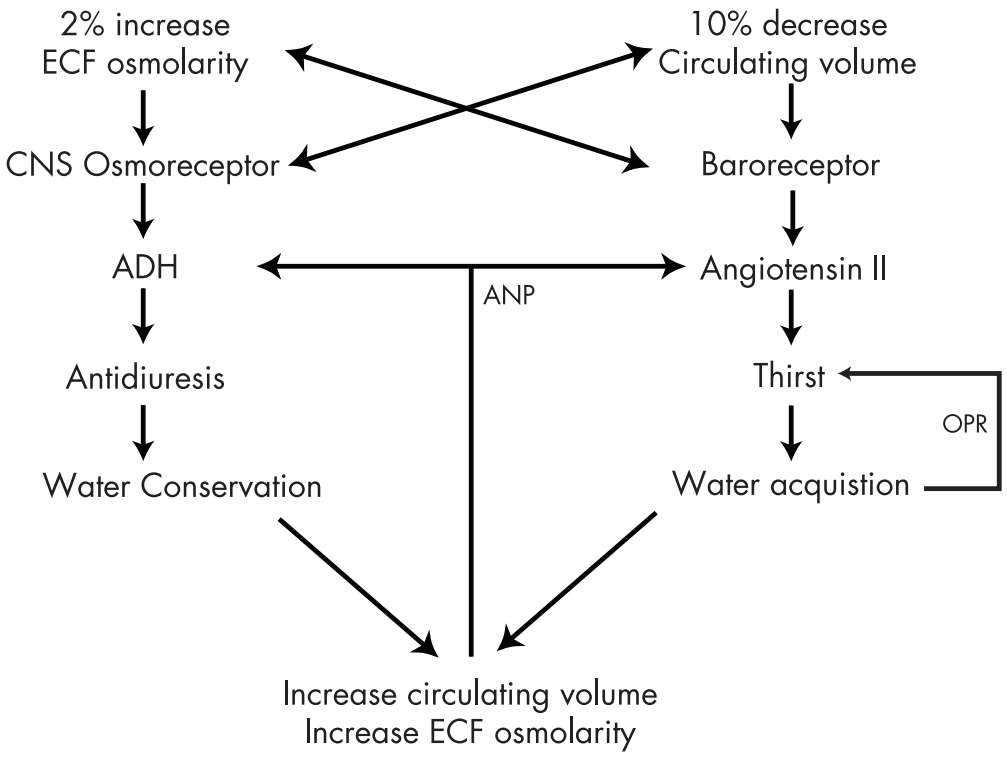
BP: blood pressure; BUN/Cr: ratio of blood urea nitrogen to creatinine; CHF: congestive heart failure; dis: disease; GI: gastrointestinal; insuff: insufficiency; Iso: isotonic; N: normal or no change; obs: obstruction; osmo: osmolarity; SIADH: syndrome of inappropriate antidiuretic hormone secretion; v: variable.

APPENDIX 3

Dehydration Clinical Pearls

- If sodium is elevated, it is likely that the patient has water-loss dehydration and needs free water, which can be given in the form of a 5% dextrose solution.
- Elevated osmolality in the presence of hyponatremia and elevated glucose suggests a hyperosmolar state caused by hyperglycemia.
- Pseudohyponatremia may be caused by hypertriglyceridemia or mannitol infusion and is treated with free water and insulin.
- If the patient is hyponatremic and hyposmolar and uric acid is elevated in the presence of metabolic alkalosis, salt-loss dehydration is likely present, provided that the patient is not fluid overloaded. This condition can be effectively treated with isotonic saline.
- In the presence of severe hyponatremia, the serum sodium level should be corrected over a few days (at a rate no greater than 1 mEq/h) to avoid cerebral pontine myelinolysis.

The Water Repletion Reaction



ECF=extracelluar fluid; CNS=central nervous system; ADH=antidiuretic hormone; ANP=aterial naturetic peptide; OPR= orapharyngeal reflex

APPENDIX 4

Indicators for Reviewing Hydration Status—A Quality-Improvement Monitoring Instrument

Place check mark on line if indicator is present.

Recognition

_____ The patient's current hydration status is defined.
_____ The consequences of dehydration are identified.
_____ Risk factors for dehydration (e.g., prolonged vomiting, diarrhea, fever, infection) are identified.
_____ A condition change has been observed that may be related to hydration.

Assessment

_____ Dehydration has been considered as the cause of an observed condition change.
_____ Factors that could increase the patient's risk of impaired hydration are assessed.
_____ There is a systematic approach to identify and manage causes of symptoms or condition changes related to hydration status OR reasons are given why the patient should not be evaluated.
_____ Medical workup has been completed if indicated.
_____ Serum osmolarity has been measured or calculated.

Treatment

_____ Underlying risk factors for and causes of dehydration are addressed, where feasible.
_____ The patient receives adequate support for personal, physical, and functional care.
_____ Medications that may be causing or increasing the risk of dehydration are tapered or stopped at least temporarily OR clinically valid reasons are given for not tapering or stopping them.
Interventions for dehydration are consistent with the patient's wishes and goals, as stated in advance directives or otherwise by the patient or surrogate decision maker.
Interventions for dehydration are consistent with the nature, severity, and causes of dehydration as defined by pertinent assessment and lab tests.

Monitoring

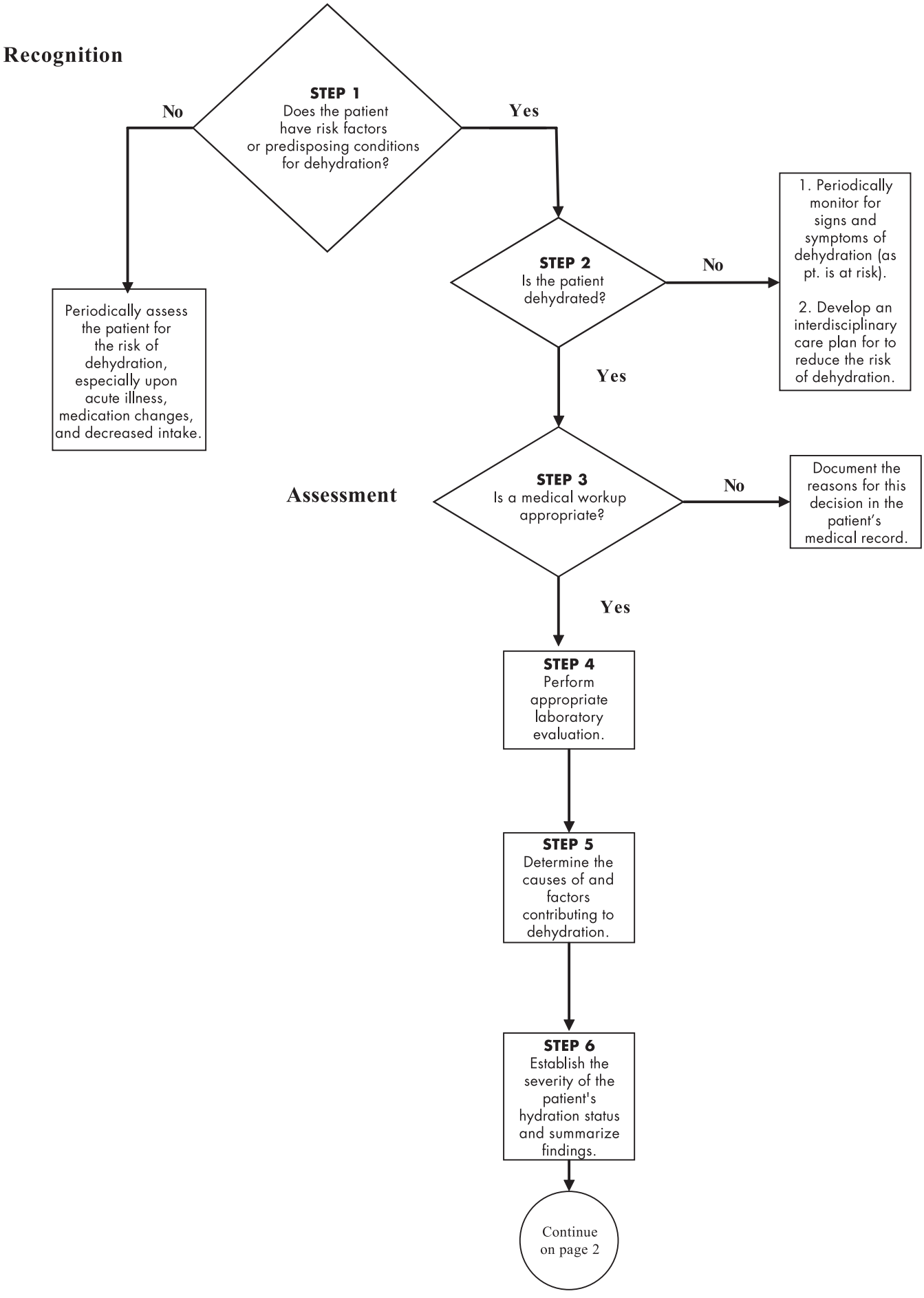
_____ The patient with dehydration is monitored until the problem is resolved or is identified as irresolvable.
_____ Treatments and other interventions are modified based on continued monitoring of the patient and key laboratory values.
_____ The at-risk patient is monitored for the development of a fluid/electrolyte imbalance.

NOTES

NOTES

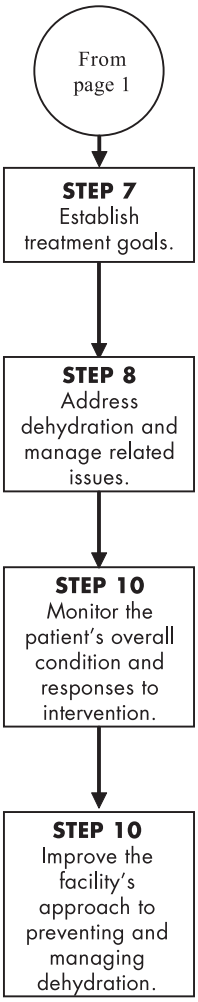
NOTES

This is the dehydration and fluid maintenance in the long-term care setting algorithm to be used in conjunction with the written text of this clinical practice guideline. The numbers next to the different components of the algorithm correspond with the steps in the text.


Recognition
STEP 1
Does the patient have risk factors or predisposing conditions for dehydration?
No
Yes
Periodically assess the patient for the risk of dehydration, especially upon acute illness, medication changes, and decreased intake.
STEP 2
Is the patient dehydrated?
No
1. Periodically monitor for signs and symptoms of dehydration (as pt. is at risk).
2. Develop an interdisciplinary care plan for to reduce the risk of dehydration.
Yes
Assessment
STEP 3
Is a medical workup appropriate?
No
Document the reasons for this decision in the patient's medical record.
Yes
STEP 4
Perform appropriate laboratory evaluation.
STEP 5
Determine the causes of and factors contributing to dehydration.
STEP 6
Establish the severity of the patient's hydration status and summarize findings.
Continue on page 2

Treatment

Monitoring



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