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## **Understanding dehydration in the elderly**

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### **ABSTRACT**

Water is vital for maintaining one's life but dehydration is a prevalent condition among the elderly, particularly during and after admissions to hospitals and nursing homes. Elderlies are vulnerable to dehydration from risk factors such as age-related impairment, chronic diseases and medications. Dehydration among the elderly can be prevented by paying more attention to their fluid intake. Education and reminders to the elderly are also useful in encouraging them to maintain fluids intake. This review paper summarises some diagnostic measurements of dehydration among the elderly. Some recommendations to elderly carers are also suggested.

**KEYWORDS:** Dehydration; elderly, risk factors, diagnosis

## 1 INTRODUCTION

Elderlies are susceptible to dehydration due to various age-related physiological changes. Physical disability, use of diuretics and renal senescence among the elderly are the increasingly common factors leading to dehydration. Dehydration is defined as “depletion in total body water content due to pathological fluid losses, diminished fluid intake, or a combination of both” (Begum & Johnson, 2010). Adequate hydration emphasises the importance of water and its role within the body which consists of 70% of water. The functions of water include thermoregulation - the maintenance of the desired body temperature of 37°C through self-regulation (Osilla, Marsidi & Sharma, 2018), acting as a buffer for acids and carrying nutrients and oxygen to all the cells via blood.

The decrease in total body water is a natural process but dehydration is a prevalent condition that affects the elderly (Miller, 2015). In Hong Kong, more than one fifth and one third of the elderly who are admitted to the hospital are dehydrated and at risk of dehydration respectively (Chan et al., 2018). Likewise, one fifth of the elderly under long-term care are dehydrated (Hooper et al., 2016). The total medical costs for patients who experienced post admission dehydration are higher because of longer length of stay, higher occurrence of catheter-associated urinary tract infection and higher in-hospital mortality than the average patients (Pash et al., 2014). Dehydration in the elderly is directly associated with the utilisation of intensive care unit and other hospital resources, including short and long term care and readmission to hospital (Frangeskou, Lopez-Valcarcel, & Serra-Majem, 2015). The mortality of dehydration among the elderly can range from 15% to 50% if dehydration is overlooked because of its linkage to infection (Begum & Johnson, 2010; Koch & Fulop, 2017). This paper aims to summarise the risk factors, diagnosis and effects of dehydration among elderly. Some strategies of managing elderly dehydration will be recommended.

## 2 RISK FACTORS OF DEHYDRATION IN THE ELDERLY

### 2.1 Age-related impairment

Age-related impairment can cause higher risk of dehydration to the elderly. Decrease in the sense of thirst is a common reason (Hooper et al., 2014; Schols et al., 2009), due to the decline of osmoreceptors and the fall in angiotensin 1 level (Puga et al., 2019). The likelihood of the elderly seeking to drink fluids on their own is consequently decreased, and so the risk of dehydration will be increased. At the same time, from the age of thirty to ninety, a loss of around one third to one half of the nephrons results diminished ability to reabsorb water and electrolytes by the kidneys back into the body (Begum & Johnson, 2010). A general decrease in the glomerular filtration rate (GFR) and renal blood flow (RBF) have been observed among older individuals, arising from the fall in GFR due to lesser flow of plasma into the glomerulus (Weinstein & Anderson, 2010). Additionally, the ageing kidney has a decreased response to the antidiuretic hormone (Begum & Johnson, 2010). This contributes to the further decline in functionality of the kidneys, causing even more water loss via urination, resulting in more risk of dehydration. Moreover, the fear of incontinence may cause the elderly to feel embarrassed and they drink less fluid to avoid going to the toilet. Other factors causing a loss of fluid include medications that increase the risk of dehydration, as well as pathologies that cause fever, diarrhoea or vomiting (Ferry, 2005). Likewise, limited mobility may increase the risk of dehydration among the elderly because they may not be willing to drink more water or going to the toilet.

Total body water decreases with age and affects females rather than males. On average, a child's body consists of 80% water while adults from age 61 to 74 contain around 40% and 50% water in females and males respectively, making the elderly to become dehydrated more

easily (Bennett, 2000). The female elderly have a higher risk of dehydration than male because they have a lower total body water content and on average a smaller muscle mass than men, as well as being more susceptible to disuse muscle atrophy in comparison to men (Rosa-Caldwell & Greene, 2019).

## **2.2 Lifestyle or behavioural changes**

The reduction of food consumption may raise the possibility of dehydration (Ferry, 2005). With the increase of age, the intake of food is decreasing. Carbohydrates contain the component of water, and decrease in carbohydrates means that the absorption of water decreases. In addition, some older people do not drink enough water due to swallowing and dysphagia problems. If the elderly have dementia or cognitive disorders, they may forget to drink water or unable to take action (Ferry, 2005; Frangeskou et al., 2015). The elderly who live alone or are hospitalised may be dehydrated easily because they do not recognise how much water they need or communicate thirst when caregivers or nurses have reminded them (Begum & Johnson, 2010). Besides, some of them are diagnosed with depression, and they do not have motivation to build a good diet (Frangeskou et al., 2015). Moreover, the variation of sodium and protein intake is associated with dehydration (Begum & Johnson, 2010). Research has found that the elderly may intake more sodium in their diet due to taste sensitivity decreases with age. The body's intake of fluid and electrolyte imbalances increase the risk of hydration.

## **2.3 Chronic diseases and medications intake**

Elderlies are also more prone to dehydration arising from chronic diseases (Collins & Claros, 2011; Masot et al., 2018), and acute conditions like a stroke and the associated complications of dysphagia (Rowat, Graham & Dennis, 2012; Aslam & Vaezi, 2013; Masot et al., 2018; González-Fernández et al., 2013). Certain medications for chronic diseases may worsen dehydration. Some drugs may trigger dehydration by increased water elimination through urination, diarrhoea and sweat; a fall in thirst sensation and appetite; or a change in thermoregulation. An example is Metformin, the first-line drug for type 2 diabetes, which is common among the elderly. Its side effects include diarrhoea, vomiting and nausea, causing hypohydration. Another example is diuretics, which are commonly used to treat a wide variety of health conditions including hypertension, congestive heart failure, liver failure, nephrotic syndrome and chronic kidney disease (Puga et al., 2019). It must be noted that older people tend to take a variety of medications for various illnesses and the potential accumulated side effects of different medications may increase the risk of dehydration.

# **3 DIAGNOSIS OF DEHYDRATION**

## **3.1 Physical signs**

Symptoms of dehydration can range from simple dizziness and confusion to seizures and even deaths (Picetti et al., 2017). Dehydration can be diagnosed upon physical examination. General signs include a fatigued appearance, pallor, sunken periorbital areas, and chapped lips (Miller, 2015). Other symptoms and signs include dry lips, skin and tongue, headaches, lack of focus, light-headedness, muscle weakness, rapid breathing and muscle cramps. In a serious stage of dehydration, physical signs of dehydration may include difficulty in walking, confusion, and rapid heart rate.

Signs of dehydration in younger patients such as dry mouth or tongue, thirst, or headaches (Shaheen et al., 2018), are not always found in the elderly. This is due to the various effects ageing may bring about. Thirst threshold decreases as one ages (Bennett, 2000; Bunn et al., 2015). However, the symptoms could very well be due to breathing through the mouth

or from medications that cause mouth dryness (Bennett, 2000). In elderly patients, clinical signs of dehydration may occur only in the later stages of dehydration.

As the water depletion versus salt and water depletion show distinct clinical findings in dehydration, the misconception of the distinction can cause delayed recognition of water depletion. Therefore, comprehending the difference between the two is important to diagnose dehydration in elderly patients. Hyponatremia, high urine osmolality, and hyperosmolality are noted in water depletion (Friedler, Koffler, & Kurokawa, 1977). For sodium and water depletion, the characteristics include the increase in blood urea nitrogen and blood urea nitrogen/creatinine ratios. Serum osmolality and sodium level of haemoconcentration will be high, low, or normal. The common physical findings in dehydration consist of reduction in skin turgor and alters in orthostatic blood pressure due to the general reduction in extracellular volume and intravascular hypovolemia (Lavizzo-Mourey, 1987). However, skin elasticity and subcutaneous fat reduce with age. Hence, physical sign of skin turgor change is usually an unreliable finding in the elderly patients.

### 3.2 Clinical assessment

Measuring hydration status is complex and difficult. There has been much debate surrounding the best method in assessing whether an individual is dehydrated (Hooper et al., 2014). Few assessment methods have been proven to accurately measure fluid compartments within the body. There has been little application in practice, and the diagnostic accuracy remains questionable (Bak et al., 2017).

Serum or plasma osmolality is a good marker of water-loss dehydration (Hooper et al., 2014). It is suggested to be the best method to diagnose hydration status in a single point in time. However, assessments of urine specific gravity, colour and osmolality markers have poor diagnostic accuracy. This is most likely due to declining renal functions as one ages (Lacey et al., 2019). Moreover, serum/plasma osmolality cannot be used to assess chronic hydration status, as it constantly changes (Rodrigues et al., 2015).

Isotope tracers is a contender for the gold standard of measuring dehydration. It relies on the theory that fluid is constantly exchanged between compartments and is distributed equally throughout the body. It is able to measure total body water, extracellular and intracellular fluid compartments directly, through the use of stable isotopes. This increases the accuracy of determining hydration status in a controlled environment (Bak et al., 2017). However, isotope tracers are unable to measure interstitial fluid and hence, and it is unable to fully capture the dynamic interplay of multiple variables (Lacey et al., 2019). A new dehydration-screening tool (DST) is currently being developed, allowing the identification of the elderly most likely at risk for dehydration within an institutionalised and community-dwelling population. The geriatric DST tool resulted in a 'Hydration Score' which is inversely related with urine osmolality (Rodrigues et al., 2015).

## 4 EFFECTS OF DEHYDRATION

Dehydration has severe negative effects on health and wellbeing. The risk of mortality pertaining to suffer from acute illness increases with dehydration (Shells & Morrell-Scott, 2018). In particular, dehydration increases the likelihood of thromboembolic complications, urinary tract infections, pulmonary infections, kidney stones, hyperthermia, constipation and orthostatic hypotension (Schols et al., 2009). Dehydration after an acute ischemic stroke is strongly associated with venous thromboembolism, which is a leading associated cause of death (Kelly et al., 2004). Kidney function is affected after dehydration which may trigger the

formation of kidney stone and urinary tract infection (Xiao, Barber & Campbell, 2004). Theoretically, if urine volume is low, it can be easily saturated with various solutes including calcium, oxalate, phosphorus and uric acid. Additionally, acute kidney injury is linked to dehydration. Half of the dehydrated older adults were diagnosed with acute kidney injury, while less than 16% of the patients with acute kidney injury were not diagnosed with dehydration (El-Sharkawy et al., 2017).

Dehydration can cause cognitive performance and mental impairment in the elderly (Popkin, D'Anci & Rosenberg, 2010). Mental confusion known as delirium, irritability and sleepiness are the main symptoms of dehydration in the elderly. Furthermore, poorer hydration has been statistically associated with poorer memory and slower psychomotor speed (Pross, 2017). Dehydration greater than 2% leads to a fall in short-term memory for the presentation of visual and numerical material in the elderly. Impaired mnemonic ability was observed when the elderly is deprived of water throughout the night (Adan, 2012).

## **5 RECOMMENDATIONS**

In nursing homes and hospitals, staff should ask the elderly to drink fluids even when they do not feel thirsty. The elderly should observe and report any decrease in urine output to the attending general practitioners (Westaway et al., 2015). Other strategies aiming at having more accessible fluids to the elderly have been suggested. Water should be provided at the elderly bedside all the time, with cups and pitchers within reach and being light enough for them to use. Moreover, the daily routine of the nursing homes should include snack and drink time in order to motivate the elderly to consume more fluids regularly. The elderly should be encouraged to take liquid during meal times. The fluid intake and colour of the urine should be regularly recorded and reported for early detection of dehydration (Thomas et al., 2008). Additionally, education programmes and information regarding risk factors, monitoring and early management strategies should be given to staff working with elderly patients (Wotton, Crannitch & Munt, 2008). The concept of assorting appropriate beverages and education to seniors and nurses in nursing homes could improve the fluid intake among elderly (Willms et al., 2003). On the other hand, it has been found that high contrast of the dining environment, such as red or blue compared with white tableware, could significantly increase food and liquid intake among the elderly (Dunne et al., 2004; Cook et al., 2019). The change of the dining conditions, including having different colours of dinnerware, is feasible in the nursing homes. Furthermore, offering more variety of drinks may facilitate fluid intake (Cook et al., 2019). Therefore, it is a practical strategy to promote educational programme of dehydration and make some adjustments to the design of diet and environment in the nursing homes.

In the community, the elderly and their carers should also be educated about the risks and effects of dehydration. Food with high water content such as fruits and alternative drinks should be introduced to the elderly (Ferry, 2005) and the elderly should avoid coffee, tea, soft drinks, alcohol and liquid diet supplements (Bennett, 2000). Also, the minimum total fluid intake 1.6L and 2L per day is recommended for female and male elderly respectively (Masot et al., 2020). Some information booths, leaflets and visual aids should be delivered to different districts to enhance the knowledge of the elderly and their carers. For the homebound elderly, the availability of the drinks is essential to keep them hydrated. Carers should provide aids for the elderly to facilitate and encourage drinking more fluid if necessary.

## **6 CONCLUSION**

Dehydration is commonly found in the elderly who live in nursing homes and hospitals due to age-related impairment or intake of various medications. It is vital for the staff of nursing

homes and hospitals to take adequate and regular notice of dehydration among the elderly. In order to cope with dehydration in the elderly, there are some recommended basic strategies, including education, observation, report and use of high contrast tableware, to reduce the chance of dehydration. Carers of the elderly should always be aware of the fluid intake of the elderly.

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