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What does Diabetes have to do with Cognition and Swallowing?

Marnie Kershner and Paula Leslie

Abstract

Speech-language pathologists working with adults in medical settings are likely to encounter patients with a diagnosis of diabetes mellitus on a regular basis (NCD Risk Factor Collaboration, 2016). The current literature supports an association between diabetes and mild cognitive impairment (Moreira, Soldera, Cury, Meireles, & Kupfer, 2015; Vincent & Hall, 2015). Mild impairments in executive functioning are of particular relevance in this population. Even within the range of normal cognitive abilities, reduced executive functioning can negatively impact patients' self-management of their diabetes (and potentially adherence to therapy programs and strategies) and therefore their overall health. Mild cognitive deficits in this population are therefore clinically relevant and may warrant intervention (Vincent & Hall, 2015). Diabetic complications may also impact digestion, indirectly impacting patients' intake and tolerance of food and drink (Borgnakke, Anderson, Shannon, & Jivanescu, 2015; Gatopoulou, Papanas, & Maltezos, 2012; Hüppe et al., 1992; Sandberg, Sundberg, Fjellstrom, & Wikblad, 2000).

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Learning Objectives

- 1) Describe common complications of diabetes.
- 2) Describe cognitive impairments associated with diabetes.
- 3) State the potential impact of diabetes on swallowing.

In type II diabetes the body destroys insulin-producing beta cells of the pancreas (necessary for blood sugar regulation) and develops insulin resistance.

Macrovasculature (large blood vessels) and microvasculature (small blood vessels) can be damaged in diabetes. Common microvascular complications include retinopathy, nephropathy and neuropathy. These are vascular-based disorders of the eyes, kidneys and nerves respectively (Ghosh & Collier, 2012). Distal structures such as the hands and feet are typically affected first because they are especially rich in microvasculature. The microvasculature of the digestive tract and brain are also susceptible. The blood supply to nerves may be progressively destroyed (i.e., neuropathy) in diabetes resulting in the progressive reduction of viable nerves (Moreira, Soldera, Cury, Meireles & Kupfer, 2015) as nerves require adequate blood supply to function and survive. Risk factors for diabetic neuropathy include obesity, hypertension, tobacco use, a family history of diabetic neuropathy and advancing age (Unger, 2013).

So how do patients with diabetes fit into the speech-language pathology scope of practice? The American Speech-Language Hearing Association (ASHA) supports and encourages speech-language pathologists (SLPs) to contribute to the interdisciplinary care of patients with

Dibetes is a chronic, progressive disease with the potential to lead to significant disability. Diabetes impacts endocrine and vascular function. Type I diabetes is typically diagnosed in childhood or early adulthood where the body does not make its own insulin and people need to take insulin daily. Type II is typically diagnosed in adulthood (Unger, 2013). Type II is more common than type I accounting for 90-95% of all diabetes cases in the US (Ghosh & Collier, 2012; National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2016). According to a 2017 report from the Centers for Disease Control and Prevention, approximately 30.3 million people in the US had diabetes equivalent to the populations of New York and Michigan states combined (CDC, 2017).

cognitive, communication and/or swallowing impairments secondary to neurological disease resulting in functional deficits (ASHA, 2016). Patients with diabetes may fit into this category with complications such as neuropathic impairments of cognition and/or swallow function. Understanding how diabetes complications can contribute to impairments within the SLPs' scope of practice is necessary to providing individualized, evidence-based care. The SLP's role may include screening, assessment, treatment, patient advocacy, education, counseling and/or referring to other professionals.

Diabetic Complications: Cognition

Type II diabetes has been found to be associated with reduced performance on executive functioning tasks in adults. In a 2015 meta-analysis, adults with type II diabetes showed reduced performance *across* executive functioning tasks when compared to healthy controls (verbal fluency, mental flexibility, inhibition and attention) (Vincent & Hall, 2015). The effect sizes across executive function domains were small, but consistent and these findings are clinically relevant. Impaired executive functioning, even within the normal range "... has been linked to worse adherence to medical treatment, physical activity non-adherence, and worse dietary control, all of which are important to adequate [type II diabetes] management" (Vincent & Hall, 2015, p.639).

Studies of animal models with microvascular disease due to diabetes have found functional and structural changes in the brains of these animals. These changes caused impaired cerebral perfusion (blood flow) and impaired neural recovery after insult (e.g., following a cerebrovascular accident or traumatic brain injury) (De Silva & Faraci, 2016). These findings help us hypothesize what the underlying mechanisms of cognitive-communication impairment may be in humans with diseases impacting the microvasculature. At present, the clinical literature on this topic in human subjects is limited and inconclusive (Moreira et al., 2015).

SLPs working with adults in healthcare settings are aware that medical diagnoses rarely present in isolation, particularly for older adults (≥ 65 years). Approximately 60% of older adults with diabetes have at least one additional chronic medical condition; up to 40% have ≥ 4 chronic medical conditions (Huang, 2016). Older adults may have multiple chronic medical conditions that carry risk for cognitive impairment. As an example: older hospitalized adults with heart failure

scored poorer on the Mini Mental State Exam when compared to healthy controls and those who also had diabetes scored even lower (Basile et al., 2013).

Diabetic Complications: The Digestive Tract

Safe and comfortable tolerance of an oral diet requires more than the safe passage of food and drink through the upper esophageal sphincter. The entire digestive tract plays a role. Diabetes can have harmful effects throughout the digestive tract. Starting in the mouth, diabetes is associated with a higher risk for poor oral health – and consequently – poor oral hygiene (Borgnakke, Anderson, Shannon, & Jivanescu, 2015; Sandberg, Sundberg, Fjellström & Wikblad, 2000). Poor oral hygiene, in the setting of aspiration or oral secretions, is an established risk factor for developing pneumonia (Yoneyama et al., 2002). In an exploratory case-control study the prevalence of xerostomia (i.e., dry mouth), advanced periodontitis, oral mucosa abnormalities, plaque and bleeding gums were significantly greater in adults with type II diabetes when compared to healthy controls (Sandberg et al., 2000).

Autonomic neuropathy (primarily affecting nerves that regulate internal organs) related to diabetes can result in additional dysfunction further down the digestive tract (Gatopoulou, Papnas & Maltezos, 2012; Hüppe et al., 1992). These impairments include esophageal dysmotility, gastroesophageal reflux disease (GERD), gastroparesis (impaired emptying of the stomach), constipation, diarrhea and fecal incontinence. These impairments in digestion are essential for the SLP to be aware of because they impact patients' tolerance of oral diets, and may increase risk for aspiration of gastric contents (as may be the case for a patient with esophageal dysmotility, GERD, gastroparesis or constipation).

Polypharmacy

With advanced age and multiple chronic medical conditions (a common combination in older adults with diabetes) comes a greater risk of polypharmacy. Polypharmacy may be defined as "...the use of more medications than are medically necessary" (Maher, Hanlon & Hajjar, 2014, p. 1). Others define polypharmacy as the use of multiple medications at one time, with various cut-offs for the number of medications. Medication side effects can trigger a prescription cascade; drugs can start to be added to a patient's list to manage symptoms that are actually side effects of other medications (Wise, 2013). Adverse medication interactions and medication side effects can cause or contribute to deficits in cognition and swallow

function (Gallagher & Naidoo, 2009; Maher et al., 2014). Dysphagia may be induced by medications, or indirectly impacted by medications (e.g., reduced nutritional status, dehydration, dry mouth, impaired taste, reduced oral hygiene/health) (Gallagher & Naidoo, 2009). When in doubt, it is appropriate for the SLP to suggest that the medical team consider a medication review with the aim to reduce the overall burden on the patient.

Recommendations for Management - SLP Role

Diabetes is associated with mild cognitive impairments (Moreira et al., 2015; Vincent & Hall, 2015). Mild impairments in executive functioning, even within the range of normal, are clinically relevant and may warrant intervention (Vincent & Hall, 2015). Careful screening and higher-level assessment should be considered to identify subtle impairments in patients with diabetes.

Cognitive treatment should focus on functional compensatory strategies, taught in the context of daily tasks relevant to patients' specific needs (Moro et al., 2015). For patients with diabetes, tasks may relate to increasing independence in disease management (e.g., monitoring blood sugar, managing medications). Significant others and/or caregivers should be included in treatment when possible to support generalization (Moro et al., 2015). Referrals to dentistry and gastroenterology are encouraged given the established associations between diabetes (\pm diabetic neuropathy) and poor oral health (Borgnakke et al., 2015; Sandberg et al., 2000), and between diabetic neuropathy and a variety of gastrointestinal (GI) complications (Gatopoulou et al., 2012; Hüppe et al., 1992).

Practicalities of Management. The SLPs role in addressing cognition in patients with diabetes may include advocacy, screening, assessment, treatment, counseling, education and/or onward referrals.

- Executive functioning impairments are of particular concern in this population, and especially for individuals who do not have daily assistance with diabetes management. When in doubt, screen.
- Treatment should be functional and related to the patient's specific day-to-day needs.
- Significant others and/or caregivers should be involved when possible to support carryover.
- The *Mild Cognitive Impairment Questionnaire* (Dean, Jenkinson, Wilcock, & Walker, 2014) evaluates emotional and practical quality of life concerns in adults with mild cognitive impairment and may be a helpful tool to consider for patients in this population.

Interdisciplinary Considerations. When responding to swallow consults for patients with diabetes (especially for consults related to "poor PO intake") the SLP should remember that the oropharynx does not exist in isolation. While periodontitis and gastroparesis are outside of the SLP scope – making appropriate referrals is within the SLP scope.

- Such referrals may be made to:
 - Dentistry
 - Gastroenterology
 - Pharmacy

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