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Relationship Between Type 2 Diabetes Mellitus and Depression

Kayla L. Bachand

College of Nursing and Professional Disciplines

University of North Dakota
Abstract

Diabetes and depression are prevalent diseases worldwide. In the United States, it is estimated 30.3 million people of all ages have diabetes and 90-95% of those cases have type 2 diabetes mellitus (T2DM). Additionally, approximately two of five Americans will develop T2DM within their lifetime (Centers for Disease Control and Prevention, 2017b). "Clinically significant depression is present in one of every four people with T2DM. A diagnosis of T2DM increases the risk of incident depression and can contribute to a more severe course of depression" (Semenkovich, Brown, Svrakic, & Lustman, 2015, p. 577). This case study was regarding a newly diagnosed and noncompliant patient who was seen in the clinic for a follow-up of her T2DM management. This situation occurs in every clinic nationwide and affects many patients every day. These patients need a lot of education and close follow-up to assess them for the comorbid conditions they are at risk for, like depression. Depression occurrence is two to three times higher in people with T2DM (Bădescu et al., 2016). It is thought that there is some neurobiological link between T2DM and depression, and that women are more likely than men to become depressed. Research has also shown that depression significantly impacts the quality of life for those individuals with T2DM. This review shows the association between T2DM and depression, highlights the importance of identifying depression in patients with T2DM, and identifies possible ways to address both diseases.
Relationship Between Type 2 Diabetes Mellitus and Depression

**Background**

In 2013 the American Diabetes Association reported that every 21 seconds someone in the United States was being diagnosed with diabetes. In 2016 it was reported that 30.0 million physician office visits and 14.0 million emergency department visits occurred where diabetes was the primary diagnosis in the United States. In the year 2014 for every 100,000 people, 24 were dying from diabetes, making that a total of 76,488 deaths related to diabetes in the United States that year (Centers for Disease Control and Prevention, 2017a). In 2015, T2DM affected more than 9% of the global population and depression affected 5%. These two conditions are the leading global causes of morbidity and mortality (Naicker et al., 2017).

This case study focuses on a patient problem that is commonly seen in clinics worldwide, a patient newly diagnosed with T2DM who is noncompliant with T2DM self care in the clinic for a follow-up of her T2DM management. Patients with T2DM are at risk for several complications from uncontrolled T2DM as well as an increased risk for comorbid conditions. The comorbid condition, depression, is the focus of this case study as depression affects 25% of patients with T2DM (Naicker et al., 2017). Healthcare providers need to be aware of how a diagnosis of T2DM increases the patients risk for depression. This includes how to appropriately screen patients, provide education about T2DM and depression, and intervene when needed.

The exact association between T2DM and depression is difficult to assess due to multiple factors affecting both diseases. This paper shows more research is needed on the relationship between depression and T2DM. Current research has shown there are neurological changes that occur in both diseases and that there is an inflammatory response also impacting the disease processes. Additionally, it is hypothesized women are at a greater risk along with those of a
lower socioeconomic status, and less years of education. Even in patients with prediabetes and in patients with undiagnosed diabetes, research shows moderately increased rates of depression. There is markedly increased rates of depression in the patients previously diagnosed with diabetes compared to individuals with normal glucose metabolism (Bădescu et al., 2016).

**Case Report**

SJ is a 60 year-old female, who presented to the clinic for a follow-up of T2DM management. Vital signs were: blood pressure-148/98, pulse- 80, respiration rate-20, and temperature-98.6F. SJ has had hypertension and T2DM for two years. She monitors her blood sugars in the morning two times per week and her blood sugars range between 150-200 mg/dl. Her family history includes: father- T2DM and coronary artery bypass graft (CABG), mother-CABG, uncle-colon cancer, grandpa-colon cancer, brother-CABG, and other brother- T2DM. She is a pharmacy technician at a hospital. She does a lot of walking for her job but denies routine exercise. She tries to adhere to a diabetic diet but struggles with carbohydrate counting. She is up to date with dental care, eye care, mammograms, and flu vaccine. She is due for a colonoscopy and pneumococcal 12 vaccine.

**Medications:**
- Metformin 500mg twice daily
- Aspirin 81mg daily
- Lisinopril 20mg daily
- Atorvastatin 20mg daily
- Multivitamin daily

**Allergies:** Penicillin

**ROS:**
- General: Denies weakness, fatigue, fever, or chills.
- Cardiac: Denies angina, murmur, or palpitations.
- Respiratory: Denies cough, dyspnea, wheezing, hemoptysis.
- Endocrine: Denies polydipsia, dysphagia, polyuria, cold, or heat intolerance.
- Neurologic: Reports numbness and tingling to left big toe.
- Psychiatric: Denies any depression, mood changes, difficulty concentrating, anxiety, sleep disturbances.
Physical:
Constitutional: She is oriented to person, place, and time. Vital signs are normal. She appears well-developed and well-nourished.
Skin/nails: Skin is warm, dry, and intact. Skin on feet are dry.
Pulmonary/Chest: chest symmetrical expansion. Clear to auscultation throughout posterior and anterior lung field. No respiratory distress.
Cardiac: regular rate and rhythm, normal S1 and S2, no S3, S4, rubs, or murmurs.
Vascular: radial and pedal pulses 2+ bilaterally and no edema present.
Psychiatric: Normal mood and affect.

Diabetic Foot Screen for Loss of Protective Sensation
Patient responded to all of the above areas appropriately. No open sores or cracks noted on her feet or between her toes.

Labs:

<table>
<thead>
<tr>
<th>Hgb A1C</th>
<th>7.8 (H)</th>
<th>4.2-6.0%</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Comprehensive Metabolic Panel</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>138 (H)</td>
</tr>
<tr>
<td>BUN</td>
<td>21</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.99</td>
</tr>
<tr>
<td>BUN/Creatinine Ratio</td>
<td>21.2</td>
</tr>
<tr>
<td>Sodium</td>
<td>139</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.5</td>
</tr>
<tr>
<td>Chloride</td>
<td>103</td>
</tr>
<tr>
<td>CO2</td>
<td>24</td>
</tr>
<tr>
<td>Anion Gap with K</td>
<td>17</td>
</tr>
<tr>
<td>Calcium</td>
<td>9.5</td>
</tr>
<tr>
<td>Protein Total</td>
<td>6.7</td>
</tr>
<tr>
<td>Albumin</td>
<td>3.9</td>
</tr>
<tr>
<td>Alkaline Phosphate</td>
<td>78</td>
</tr>
<tr>
<td>AST/SGOT</td>
<td>22</td>
</tr>
<tr>
<td>ALT/SGPT</td>
<td>13</td>
</tr>
<tr>
<td>Bilirubin Total</td>
<td>0.3</td>
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<tr>
<td>Corrected Calcium</td>
<td>9.6</td>
</tr>
<tr>
<td>eGFR Non-African American</td>
<td>53 (L)</td>
</tr>
<tr>
<td>EGFR African American</td>
<td>64</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cholesterol</th>
<th>220 (H)</th>
<th>100-200 mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglyceride</td>
<td>186 (H)</td>
<td>50-150 mg/dL</td>
</tr>
<tr>
<td>HDL</td>
<td>36 (L)</td>
<td>40-80 mg/dL</td>
</tr>
<tr>
<td>LDL</td>
<td>110</td>
<td>0-120 mg/dL</td>
</tr>
</tbody>
</table>

Plan:
1. **Uncontrolled Type 2 diabetes mellitus without complications** E11.9
   - Increase the metformin to 1,000mg bid, titrate up to this dose. Patient will log blood sugars for 1 week and diabetic educator will call the patient. Set up nutrition counseling for education on carbohydrate counting. Recheck A1C in 3 months.

2. **Hypertension, benign essential, goal below 140/90** I10
- Increase lisinopril from 20mg to 40mg daily.

3. **Mixed hyperlipidemia** E78.2
   - Increase atorvastatin from 20mg to 40mg daily.

**Follow-up:** Diabetes management follow-up in 3 months.

**Literature Review**

**Neurobiological Link between T2DM and Depression**

The association between T2DM and depression is difficult to state as multiple factors affect T2DM and depression. Therefore, more research is needed in this area. Recent research has shown that there are neurological changes that occur with both diseases and the body’s inflammatory response is affected based on the increased production of inflammatory cytokines. Additionally, there is speculation that women, those of lower socioeconomic status, and those with less years of education are at a greater risk for depression. These will be discussed in this next section.

Low socioeconomic status, poor sleep, lack of physical exercise, and a poor diet are environmental factors that predispose patients to T2DM and depression. These factors activate the bodies’ stress response system and over time will become chronic stress (Bădescu et al., 2016). “Chronic stress activates the hypothalamus-pituitary-adrenal axis (HPA-axis) and the sympathetic nervous system (SNS), increasing the production of cortisol in the adrenal cortex and the production of adrenalin and noradrenalin in the adrenal medulla” (Bădescu et al., 2016, p. 121). Chronically elevated cortisol levels and continual activation of the SNS also leads to the production of inflammatory cytokines. An increased production in cytokines can impair the normal functioning of the pancreatic B-cells, leading to insulin resistance and eventually promote T2DM (Bădescu et al., 2016).
Many new studies suggest that inflammatory responses are also involved in the pathophysiology of depression. Proinflammatory cytokines have been found to interact with many of the pathophysiological domains that characterize depression, including neurotransmitter metabolism, neuroendocrine function, synaptic plasticity, and behavior (Bădescu et al., 2016, p. 121).

These correlations suggest the increased levels of stress as well as activation of the stress response and inflammatory markers increases the risk of developing depression in patients with T2DM.

Another hypothesis for the association between T2DM and depression is related to the reduced neuroplasticity of the brain in patients with T2DM and depression. “Neuroplasticity refers to the ability of the brain to respond and adapt to environmental stressors or disease in regions associated with affective expression, learning and memory, and HPA axis regulation” (Doyle, Halaris, & Rao, 2014, p. 560). The regions most affected by neuroplasticity are the hippocampus and dentate gyrus. The hippocampus is associated with memory and regulating our emotions. The dentate gyrus, which is part of the hippocampus, is one of only two regions in the brain that can regenerate neurons over the lifetime. This process is known as neurogenesis (Doyle, Halaris, & Rao, 2014).

The brain is highly adaptable to acute stress but with chronic stress, which T2DM produces in the body, the brain is unable to adapt as well (Doyle, Halaris, & Rao, 2014). There is a lack of research on why these anatomical brain changes occur; however, neuroplasticity appears to be an underlying biological factor associated with T2DM and depression (Doyle, Halaris, & Rao, 2014). With both of these brain regions being compromised equally, the
patient’s affective processing, cognition, and behavior will be affected, all predisposing the individual to developing depression.

**Impact of Depression on Quality of Life**

Several studies have found depression significantly decreased the quality of life in patients with T2DM (Semenkovich et al., 2015). A study by Das et al., (2013) looked at depression in patients who had T2DM for about 3-4 years and their quality of life. The 11 month study consisted of 195 patients (81 males and 114 females), ages 18-60 years with the mean of 44 years. Of the 195 patients, 90 had depression, and 105 did not. Hemoglobin A1c (HbA1c) levels were measured the day of the interview, and all patients were assessed with the Hamilton Rating Scale for Depression and Quality of Life Enjoyment and Satisfaction to measure quality of life.

Results from Das et al (2013) showed patients with depression had significantly higher HbA1c levels (8.2 vs 6.7 with $P<0.001$) and lower quality of life scores. The quality of life questionnaire showed those with depression scored lower on physical health, mood, work, household activity, social and family relationships, leisure time activity, ability to function in daily life, sexual drive, economic status, living/housing situation, ability to get around physically, and overall sense of well being (Das et al., 2013). This study found that 46.15% of patients with T2DM were moderately depressed. Age, gender, religion, and family type were not found to be contributing factors to depression in this study. A contributing factor to the development of depression in T2DM patients was HbA1c and suggests that poor glycemic control is a contributing factor for depression (Das et al., 2013).

In patients with T2DM, depression impacts multiple aspects of their lives as Das et al. (2013) showed a decline in quality of life scores. Additionally, lifestyle factors contribute to the
decline in T2DM itself. In studies by Chien, Wu, Lin, Chou, and Chou (2012) and Tu et al. (2017), patients with T2DM and depression were least likely to adhere to their self-care regimens, especially monitoring their glucose levels. These patients also were least likely to adhere to a diabetic diet, exercise programs, and take their medications as directed. Patients with T2DM were also more prone to develop other psychological conditions such as more severe depression symptoms and anxiety disorders (Tu et al., 2017). “Patients with comorbid T2DM mellitus and depression experience a number of adverse health complications that negatively affect the outcomes of both diseases” (Tu et al., 2017, p. 152).

**Risk Factors for Depression**

Arshad and Alvi (2016) conducted an observational study to determine the frequency of depression and identify predictive factors in patients with T2DM. The study consisted of 133 patients, 55 males and 78 females with the average age of 51. The median education was 5 years and median duration of T2DM was 3 years. A Patient Health Questionnaire-9 (PHQ-9) was used with scores greater than 5 indicating depression. Fasting plasma glucose and HbA1c were also measured. Results showed 51 patients (38.35%) had depression with female gender, lesser education, shorter duration of T2DM, and higher BMI being significantly associated (p=0.008) with depression (Arshad & Alvi, 2016). A study conducted in Bangladesh also found a statistical significant difference with income, waist-to-hip ratio, and female gender (p<0.001) in individuals that had T2DM and depression (Chowdhury et al, 2017).

The rationale of increased risk in females is hypothesized to be related to hormonal differences between males and females, the effects of child-birth, difference in psychosocial stressors, and behavioral models of learned helplessness (Tu et al., 2017). Patients with T2DM, who were females between the ages of 45-54 and older than 65 were more likely to develop
depression. Low income also predisposed patients to a greater chance of developing depression (Huang, Lin, Lee, Chang, & Chiu, 2012).

**Interventions to Decrease the Incidence of Depression**

Several studies have shown the prevalence and incidence of patients with T2DM developing depression are significantly higher than patients who do not have T2DM. Therefore, a number of intervention strategies have been studied to look at their effectiveness in decreasing the risk of depression in those with T2DM. One pilot trial completed by Kaltman et al. (2015) integrated an intervention that focused on behavioral activation and motivational interviewing techniques. Eighteen Latino immigrants participated in the open trial and attended six individual sessions with two monthly booster sessions to follow. “A1C levels were examined at baseline and afterwards. Participants also completed measures of depression, T2DM self-management behaviors, patient activation, and T2DM -related self-efficacy and gave open-ended feedback about the intervention” (Kaltman, et al., 2015, p. 87). Their results showed A1C levels and depressive symptoms decreased. The study’s interventions also led to improvements in self-management behaviors, patient activation, and self-efficacy related to T2DM. Their open-ended feedback was positive with patients declaring after the intervention they had better control over their sugars and had more strength and willingness to do the things they enjoyed. The participants were proud of their achievements and were able to fully understand the disease which gave them a sense of peace. These findings suggest an integrated self-management intervention for T2DM and depression in the primary care setting is feasible and has a positive impact on T2DM and depression-related outcomes (Kaltman, et al., 2015).

Xie and Deng (2017) completed a meta-analysis to explore the efficacy and additional effects of psychosocial intervention during management of patients with T2DM and depression.
The authors examined 31 studies; 2,616 T2DM patients with depression that were randomly assigned to either receive the psychosocial intervention during the DM management or not. The results showed symptoms of depression and anxiety improved in those who received the psychosocial intervention. There also was a significant effect on the patient’s glycemic control, fasting-plasma glucose levels, and HbA1c. Their study showed psychosocial intervention had a positive impact on those individuals with T2DM and depression (Xie & Deng, 2017).

Additionally, research has been done to determine if T2DM leads to depression or vice versa and how to prevent them both from occurring. One article proposed for healthcare providers to not view T2DM and depression as separate conditions that may exist together. Instead Fisher, Chan, Nan, Sartorius, and Oldenburg (2012) suggested healthcare providers treat both T2DM and depression with an integrated approach. “The treatment of depression becomes a routine part of T2DM care, just as foot care and yearly retinal checks. So, too, the psychological or medical treatment of depression may be expanded to address its routine metabolic and cardiovascular dimensions” (Fisher et al., 2012, p. 560). When discussing promoting physical exercise and goal setting with these patients, healthcare providers should emphasize and educate on the benefits to not only their physical health but also their mental health. Additionally, “depression must be addressed before patients may be expected to marshal sufficient energy to manage their diabetes” (Fisher et al., 2012, p. 562). By using integrated care with collaboration between several interdisciplinary teams, clinical outcomes would be improved in T2DM and depression.

**Conclusion**

Several studies have found patients with T2DM are at a greater risk for developing depression, more specially females with a lower income. “During the course of their illness,
patients with comorbid T2DM and depression experience a number of adverse health complications that negatively affect the outcomes of both diseases” (Tu et al., 2017, p. 152). With this knowledge healthcare providers should screen patients with T2DM for depression, especially those more vulnerable. More emphasis needs to be put on prevention and treatment of depression disorders among patients with T2DM (Huang et al., 2012). Interventions need to be implemented in primary care to help decrease the burden patients with T2DM experience in order to reduce their risk of depression. These strategies need to be implemented immediately at the diagnosis of T2DM and continued through the patient’s lifespan (Hunter et al., 2018).

**Learning Points**

- An average of 25% of patients with T2DM will go on to develop depression.
- Of those with T2DM, females between the ages of 45-54 and older than 65 from a low socioeconomic status are at the greatest risk for developing depression.
- Integrated self-management and psychosocial interventions for T2DM and depression has a positive impact on diabetes and depression-related outcomes.
- Providers need to collaborate with interdisciplinary teams and to treat T2DM and depression together to improve clinical outcomes for patients.
References


(2016). The association between diabetes mellitus and depression. *Journal of Medicine
and Life, 9*(2), 120-125. Retrieved from
https://ezproxylr.med.und.edu:2243/pmc/articles/PMC4863499/

Center for Disease Control and Prevention. (2017a). National center for health statistics:

Estimates of diabetes and its burden in the united states. Retrieved from

major depressive disorder: a population-based study. *Comprehensive Psychiatry, 53*, 569-
575. doi: 10.1016/j.comppsych.2011.06.004

type 2 diabetic patients. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews,
11S*, 1009-1012.


