

# The association between diabetes and post-traumatic stress disorder

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## Article points

1. Diabetic foot ulcers can cause psychological trauma.
2. There is a significant association between type 2 diabetes and post-traumatic stress disorder.
3. Patients should be psychologically assessed as part of multidisciplinary care.

## Key words

- Diabetic foot ulcer
- Post-traumatic stress disorder
- Trauma
- Treatment rejection

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**Up to 90% of people with diabetes face a potentially traumatic experience that can affect their physical capacity and mental wellbeing. There is a significant relationship between type 2 diabetes and post-traumatic stress disorder, therefore, patients with diabetes should be psychologically evaluated as part of their multidisciplinary care; and patients with post-traumatic stress disorder should be assessed for metabolic imbalance. In the case of a 47-year-old patient with a diabetic foot ulcer and advanced osteomyelitis, the patient had rejected suggested treatment and displayed aggressive, anxious behaviour. On referral to psychiatry, investigation revealed she was convinced her foot could be saved and had previously changed health centres when this was determined as the best course of action. As in this case, psychological issues can make it difficult for patients to take the necessary steps to manage their diabetes.**

The incidence of diabetes mellitus is not only increasing in frequency but, due to the further health-related complications it poses for patients, it is increasingly becoming a major economic and healthcare burden for individuals and society (Dinççag, 2011; Rakel and Rakel, 2011). Diabetic foot ulcers (DFUs), which pose a high risk for morbidity and mortality, are a complication that occur in one in four patients with diabetes (Taylor, 1987; Harris et al, 1995; Ramsey et al, 1999; Gregg et al, 2004; Boulton et al, 2008; Lavery et al, 2008).

Management of DFUs is a complex and multifactorial process. The psychological trauma that can result from the symptoms of diabetes and the development of a DFU is often overlooked. Being diagnosed with a chronic disease, experiencing the social shame that can result from having a chronic wound, and facing the potential loss of a limb are factors that can contribute to psychological trauma. Up to 90% of people with diabetes face a potentially traumatic experience that can affect not only their physical capacity, but their psychological health as well (O'Neal, 1983; Schaper, 2004; Khanolkar et al, 2008).

## Assessing patients for psychological disorders

According to the *Diagnostic and Statistical Manual of Mental Disorders IV Text Revision* (DSM-IV, American Psychiatric Association, 2000), in a traumatic experience leading to post-traumatic stress disorder (PTSD) “the person has experienced a real mortal or life threatening or seriously injuring event himself or witnessed a dangerous event threatening the body integrity, and the person has lived intense fear, despair and horror” (Sar, 2010).

The relationship between PTSD and type 2 diabetes is statistically significant, according to the results of a population-based study, even after controlling for sociodemographics, metabolic factors and other psychopathological conditions (Lukaschek et al, 2013). A study of immigrants in the Netherlands showed that patients diagnosed with PTSD had a higher rate of type 2 diabetes compared with those who did not have diabetes (Agyemang et al, 2012). Researchers revealed that at 3- and 6-year follow-up, there was a significant correlation between diabetes and psychological disorders, such as PTSD and panic disorder

**Table 1. The DSM-IV diagnostic criteria for post-traumatic stress disorder in adults (American Psychological Association, 2000).****A. The person has been exposed to a traumatic event in which:**

- They experienced, witnessed, or were confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others **AND**
- Their response involved intense fear, helplessness, or horror.

**B. The traumatic event is persistently re-experienced in one (or more) of the following ways:**

- Recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions
- Recurrent distressing dreams of the event
- Acting or feeling as if the traumatic event is recurring (including a sense of reliving the experience, illusions, hallucinations, and episodes of dissociative flashback, including those that occur upon awakening or when intoxicated)
- Intense psychological distress upon exposure to internal or external cues that symbolise or resemble an aspect of the traumatic event
- Physiological reactivity on exposure to internal or external cues that symbolise or resemble an aspect of the traumatic event.

**C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by three (or more) of the following:**

- Efforts to avoid thoughts, feelings or conversations associated with the trauma
- Efforts to avoid activities, places or people that cause recollections of the trauma
- Inability to recall an important aspect of the trauma
- Markedly diminished interest or participation in significant activities
- Feeling of detachment or estrangement from others
- Restricted range of affect (e.g. unable to have loving feelings)
- Sense of a foreshortened future (e.g. does not expect to have a career, marriage, children, or a normal life span).

**D. Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following:**

- Difficulty falling or staying asleep
- Irritability or outbursts of anger
- Difficulty concentrating
- Hypervigilance
- Exaggerated startle response.

**E. Duration of the disturbance (symptoms in criteria B, C, and D) is more than 1 month.****F. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.**

**Type:** acute: <3 months; chronic: >3 months; delayed onset: >6 months after the stressor

or no symptoms. Full PTSD featured at least one symptom of re-experiencing the event, three symptoms of avoidance and two symptoms of hyperarousal, lasting for at least 1 month and causing clinically significant distress or functional impairment. Consistent with prior studies, subthreshold PTSD was defined as having fewer than the required number of symptoms for full PTSD within each subcategory, but with clinically significant distress or functional impairment. Patients who reported symptoms, but did not meet the criteria for full or subthreshold PTSD, were classified as 'minimal symptoms'.

Research on a cohort of patients with diabetes and lower income showed lower levels of HbA<sub>1c</sub> (>7.0 mmol/L) significantly correlated with an incidence of lifelong PTSD, as defined by DSM-IV A, B, C and D criteria (Miller et al, 2011) (*Table 1*). It is also important to note that traumatic stress increases inflammatory somatic diseases and the risk of early mortality, and that patients diagnosed with PTSD exhibit chronic stress symptoms, which may, in turn, trigger physiological mechanisms that lead to type 2 diabetes. Patients with PTSD should, therefore, be evaluated for metabolic imbalance, just as patients with diabetes should be psychologically evaluated as part of their multidisciplinary care (Armstrong et al, 2014; Fejfarova et al, 2014).

### Case report: PTSD and diabetes

This case report examines the experience of a patient with type 2 diabetes and a recurrent DFU. The patient was diagnosed with PTSD in a psychiatric evaluation that was triggered by her refusal to comply with treatment. She was aggressive and psychiatric referral was needed for this reason. She also refused to use the medication that was suggested for her psychological condition.

### Presentation

A 47-year-old female patient with type 2 diabetes was admitted to hospital with open wounds on the dorsolateral portion of her left foot. The patient's history revealed that she had hit her foot 4–5 months prior to the consultation, resulting in an injury that had not healed, but had instead grown larger. The patient had lost 10kg in the month before presentation, and had been treated

(Miller et al, 2011). These findings show a possible behavioural pathway between diabetes and PTSD. In the study, lifetime PTSD was assessed using the Structured Clinical Interview–DSM-IV and patients were classified as having full PTSD, subthreshold PTSD, minimal symptoms

with imipenem at another hospital; she had not completed this treatment, however, due to an imipenem allergy.

The patient had been diagnosed with type 2 diabetes 8 years prior to presentation, and had been treated with intensive insulin therapy since then. The second, third and fourth toes of her right foot had been amputated 6 years earlier. The patient, who had undergone two normal spontaneous labours, had been menopausal for 6 years. She did not drink alcohol or smoke. She was able to walk comfortably until 4 months prior to presentation, when she developed Charcot joint and had become dependent on others to care for her and aid her mobility. The Charcot joint had developed around the same time as the injury that had led to the DFU.

### Evaluation

The patient's general psychological condition was moderate, orientated and cooperative. Her body mass index was 20.8, her thyroid grade was 1B, and her respiratory and cardiovascular system examinations were normal. Her abdominal examination was normal and she had no rebound, defence or hepatosplenomegaly. The patient was evaluated by the diabetic foot care team, and the DFU was determined to be Wagner grade 3 with advanced osteomyelitis (*Figure 1*). The patient was incapable of doing inversion, aversion, flexion, extension, abduction and adduction with her left foot. She was admitted to the endocrinology service. The patient's blood test results are given in *Table 2*.

### Treatment

To treat the osteomyelitis, the patient was given tigecycline. A multidisciplinary team consisting of specialists in orthopaedics, dermatology, endocrinology and infectious disease determined that the abscess should be emptied and the foot amputated. The patient rejected the treatment, however, and displayed anxious behaviours. As a result, she was referred to psychiatry.

Psychological investigation revealed that the patient was convinced her foot could be saved and had changed health centres or clinics each time amputation had been determined as the necessary treatment. According to the patient's psychiatric examination, she had the ability to evaluate reality,



*Figure 1. The foot ulcer was determined to be Wagner grade 3 with advanced osteomyelitis.*

did not exhibit mental retardation, had low levels of education, could make her own decisions and — most importantly — had acute stress disorder.

It was suggested that the patient be evaluated by a psychiatric team and she agreed. The result of that evaluation was the recommendation that she start treatment with an antidepressant, but the patient said she would not take the treatment, if prescribed.

After the patient had rejected amputation and also antidepressant therapy, she was prescribed 12U insulin glulisine before each meal. She did not want to participate in any other therapy, such as cognitive behavioural therapy. At this point, the patient was prescribed insulin glargine 18U before sleep, atorvastatin 20 mg, clopidogrel 75 mg, cilostazol 200 mg and pentoxifylline 600 mg on an ongoing basis, as well as amoxicillin clavulanate 1 g and ciprofloxacin 500 mg for 14 days, and was discharged of her own volition.

### Discussion

PTSD was originally accepted as 'Post-Vietnam syndrome', because of the high psychiatric casualty rate (20–60%) among Vietnam veterans in the early 1980s in the US (Friedman, 1981). In 1984, half a million Vietnam veterans were alleged to be suffering from this neurosis, but most of them were diagnosed as having PTSD (Fleming, 1985).

PTSD can occur after a trauma that made the individual feel they were in danger. According to US statistics, approximately six out of every ten men and five out of every ten women experience

**Table 2. The patient's test results.**

Test	Result	Reference range
HbA <sub>1c</sub>	5.5%	4.8–5.9
Erythrocyte sedimentation rate (1 hour)	103 mm	<20 mm
<b>Thyroid function tests</b>		
Anti-thyroid peroxidase antibodies	27.4 IU/ml	0–35 IU/ml
Anti-thyroglobin	<20.0 IU/ml	0–40 IU/ml
Free tri-iodothyronine (FT3)	3.08 pg/ml	2.3–4.2 pg/ml
Free thyroxine (FT4)	1.29 ng/ml	0.74–1.52 ng/ml
Thyroid-stimulating hormone	1.37 µIU/ml	0.35–5.50 µIU/ml
Procalcitonin	0.35%	0–0.99%
<b>Blood tests</b>		
Leucocyte	$8.6 \times 10^3/\mu\text{L}$	$4.5\text{--}11.0 \times 10^3/\mu\text{L}$
Neutrophil		
1%	52.2%	45–68%
Number	$4.26 \times 10^3/\mu\text{L}$	$2.02\text{--}7.46 \times 10^3/\mu\text{L}$
Lymphocyte		
% <sup>†</sup>	33.5%	22–31%
Number	$2.73 \times 10^3/\mu\text{L}$	$1.01\text{--}3.38 \times 10^3/\mu\text{L}$
Monocyte		
% <sup>†</sup>	8.3%	0–7%
Number	$0.68 \times 10^3/\mu\text{L}$	$0\text{--}0.8 \times 10^3/\mu\text{L}$
Eosinophil		
% <sup>†</sup>	5.6%	0–4.1%
Number <sup>†</sup>	$0.46 \times 10^3/\mu\text{L}$	$0\text{--}0.45 \times 10^3/\mu\text{L}$
Basophile		
1%	0.4%	0–1.8%
Number	$0.03 \times 10^3/\mu\text{L}$	$0\text{--}0.2 \times 10^3/\mu\text{L}$
Erythrocyte	$3.8 \times 10^6/\mu\text{L}$	$3.8\text{--}5.3 \times 10^6/\mu\text{L}$
Thrombocyte	$444 \times 10^3/\mu\text{L}$	$150\text{--}450 \times 10^3/\mu\text{L}$
Haemoglobin <sup>†</sup>	10.4 g/dL	11.7–16.0 g/dL
Haematocrit <sup>†</sup>	32.4%	35–47%
Mean cell volume	85.3 fL	81–101 fL
Mean corpuscular haemoglobin	27.4 pg	27–34 pg
Mean corpuscular haemoglobin concentration	32.1 g/dL	31–36 g/dL
Mean platelet volume	8 fL	7.8–11.0 fL
Red cell distribution width	14.5%	11.5–14.5%

Results: <sup>†</sup>high; \*low

suffer from PTSD is higher than men in the US (10% versus 4%, respectively) (US Department of Veterans Affairs, 2016).

Although patients with PTSD were more likely to desire treatment for their symptoms than patients with subthreshold PTSD, a substantial proportion of patients with subthreshold PTSD (73%) subjectively perceived their PTSD symptoms as sufficiently distressing to require treatment (Zlotnick et al, 2002). According to the parameters of this study, this patient's case could be considered as subthreshold PTSD.

Recurrent DFUs are the most common problem in patients with diabetes (Armstrong et al, 2004). Physicians should regularly evaluate foot health along with blood glucose levels. When evaluating foot ulcers, the clinician should examine the foot for colour, temperature, presence of oedema, pulse, formation of a callus, skin dryness, maceration between the toes and nail disorders. Neuropathy should also be evaluated by asking whether the patient has more pain at night, a feeling of burning, insensibility or twitching. Achilles tendon reflexes should be evaluated, and vascular competency (e.g. tests to determine claudication, pain at rest or ankle brachial pressure index) should be examined.

It is critical to advise patients with diabetes about how to prevent DFUs. The best way to avoid foot ulcers due to undefined traumas is by wearing suitable shoes. The patient should avoid heel-striking when walking, instead using the sole of the foot; he or she should not walk barefoot, should not wear shoes without socks, and should not wear socks that are tight at the ankles. Skin integrity is also important; creams or lotions should be used to prevent skin dryness. Toenails must be cut flat. Patients with diabetes should also be advised to take care to avoid injuries (Spencer, 2000; Türkiye Endokrin ve Metabolizma Dernegi, 2012).

About 20% of patients with diabetes will experience a DFU, and about 60% of those patients will develop a severe infection, such as osteomyelitis, which increases the risk of lower extremity amputation (Rooh et al, 2003; Agyemang et al, 2012; Lukaschek et al, 2013). Physicians should bear in mind that such complications — taken with the other general health complications posed by diabetes — can result in patients experiencing psychiatric issues, such as PTSD. Furthermore, psychological issues can, in

at least one trauma in their lives (US Department of Veterans Affairs, 2016). PTSD can develop due to many factors; approximately 7–8% of the population may be diagnosed as having PTSD at some point during their lives. The proportion of women who



turn, make it difficult for patients to take the steps necessary to control their diabetes. Patients with PTSD should be evaluated for cardiometabolic risk factors, and precautions such as diet changes, exercise and medication should be initiated as appropriate, in order to manage both the psychiatric and metabolic/neurological disorders. Two common diseases may be diagnosed in the same patient, with one delaying or limiting treatment of the other, as is apparent in this case.

## Conclusion

Diabetic education for patients and caregivers forms part of the endocrinology services treatment process in the authors' hospital. In this case, the patient did not cooperate with the treatment for her diabetes and her rejection of amputation led to a referral for psychiatric evaluation, which revealed a diagnosis of PTSD. Various psychological (economic burden, her daughter's divorce, having a grandchild, etc) and physical traumas had combined to make the patient non-concordant.

Physicians should be aware of the correlation between diabetes and PTSD, and that patients' traumatic experiences can lead to a lack of cooperation and even rejection of treatment. Diabetic foot management should take a multidisciplinary approach that includes professionals with expertise in endocrinology, internal medicine, clinical microbiology/infectious disease, vascular surgery, dermatology, podiatry and psychiatry. The biopsychosocial approach is also important. If this approach is adopted, a more successful outcome may be obtained for the patient and also for the community, as the patient, it must be remembered, is part of a wider community.

Including the patient in the team will enhance treatment and improve the patient's quality of life. In many cases it is useful to use the PTSD checklist (International Society for Traumatic Stress Studies, 2017) and perform a Structured Clinical Interview–DSM-IV at first presentation or during follow-up. ■

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