Post-traumatic stress disorder and glycaemic control

Anne Woods, Mary Terhaar

Although good glycaemic control can significantly reduce the risk of developing complications, less than one-half of people with diabetes in the US achieve target HbA_{1c} levels of 7% (The Diabetes Control and Complications Trial Research Group, 1993; American Diabetes Association, 2007). Nonadherence to medications is a major factor associated with higher HbA_{1c} (Cramer, 2004). Associations of medication nonadherence and post-traumatic stress disorder (PTSD) have been reported in the literature and epidemiological research found a higher likelihood of PTSD in people with diabetes (Dew et al, 1999; Safren et al, 2003; Shemesh et al, 2004). This study investigated the association of PTSD symptoms with HbA_{1c} levels in a sample of women with diabetes from the US being seen in the primary care setting.

The International Diabetes Federation (IDF) has noted that good glycaemic control can significantly slow the progression of the disease and reduce the risk of developing complications (IDF, 2006). Recent studies in the US reveal that only 43% of people with diabetes have achieved the American Diabetes Association (ADA) guideline target for HbA_{1c} of 7% (Saaddine et al, 2002; Kerr et al, 2004; ADA, 2007).

In a systematic review, Cramer (2004) identified that nonadherence to diabetes medications was associated with higher HbA_{1c} levels. While nonadherence to treatment is a complex, multifaceted phenomenon, recent research has explored the relationship between psychiatric disorders and poor medical compliance. Of particular interest is the relationship between treatment nonadherence and post-traumatic stress disorder (PTSD). PTSD is an anxiety disorder with characteristic symptoms developing after exposure to trauma – which can be the diagnosis of a life-threatening disease (*Table 1*; American Psychiatric Association [APA], 1995). Epidemiological studies indicate that PTSD is a highly prevalent disorder affecting nearly 8 million adults and is twice as prevalent in women compared to men (National Institute of Mental Health, 2006).

Study aims

Few studies have investigated the relationship between PTSD and either type 1 or 2 diabetes. No studies examining the relationship of PTSD, diabetes and glycaemic control in women were identified by the authors. The current study addresses this gap in the literature. It was hypothesised that among a primary care sample of women with diabetes, those with PTSD symptoms would have lower treatment regimen adherence, demonstrated by a higher HbA_{1c}, compared with those without PTSD symptoms

Article points

1. Diagnosis of life-threatening illness can be considered a trauma that could lead to post-traumatic stress disorder.
2. Avoidance symptoms of post-traumatic stress disorder potentially explain nonadherent behaviour as a mechanism to avoid being reminded of illness.
3. Women with diabetes who have poor glycaemic control have higher mean post-traumatic stress disorder scores than women with good glycaemic control.
4. Women with diabetes who have poor glycaemic control have higher mean depression scores than women with good glycaemic control.

Key words

- Post-traumatic stress disorder
- Glycaemic control
- Regimen adherence
- Depression

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Page points

1. A cross sectional, correlational design was utilised to determine the association of current post-traumatic stress disorder symptoms with recent HbA_{1c} levels.
2. Post-traumatic stress disorder symptoms were measured with the Davidson Trauma Scale.
3. Because post-traumatic stress disorder is commonly comorbid with depression, additional assessment of depressive symptoms was accomplished with the 20-item revised Center for Epidemiologic Studies–Depression (CES-D) scale.

and that this association would not be explained by other sociodemographic variables.

Materials and methods

Study design

A cross-sectional, correlational design was utilised to determine the association of current PTSD symptoms with HbA_{1c} levels obtained within the past 6 months. Approval was obtained from the Joint Committee on Clinical Investigation (JCCI) at Johns Hopkins Medicine Institutional Review Board.

Participants and procedures

A purposive sample (where the sample is selected by the researcher subjectively) of 20 women with diabetes on a low income without medical insurance was taken from a larger study on the effects of partner violence on immune function conducted at a primary care clinic for the uninsured in Baltimore, MD (Woods et al, 2005). In the original study, exclusion criteria were as follows:

- age <18 years or >60 years
- pregnant or lactating
- presenting any current active infections, malignancies or autoimmune disease
- use of street drugs
- chronic excessive alcohol intake
- use of corticosteroids.

Table 1. *The Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR) specific diagnostic criteria for PTSD (American Psychiatric Association, 2000).

- Criterion A requires two conditions: the person may experience or witness a traumatic event or be threatened with death or serious injury to self or others; and the response must involve intense fear, helplessness or horror.
- Criterion B consists of at least one persistent re-experiencing event. Re-experiencing may include distressing memories, dreams, or feelings as if the event were reoccurring.
- Criterion C involves at least three symptoms of avoidance and numbing. These include efforts to avoid thoughts, feelings, conversations, activities that are associated with the trauma or arouse memories of the trauma, an inability to recall important aspects of the trauma, diminished interest or participation in activities and feeling detached from others.
- Criterion D involves at least two symptoms of increased arousal, such as sleep disturbance, irritability, outbursts of anger, difficulty concentrating, hypervigilance and an exaggerated startle response.
- Criterion E states that symptoms from B, C, and D must be present for more than one month.
- Criterion F holds that the symptoms must cause clinically significant distress or impairment in social or occupational functioning.

Obesity and diabetes were not exclusionary owing to the high prevalence of these conditions in urban Baltimore. The purposive sample were similar to the urban population of Baltimore in terms of race and obesity and similar in all aspects to the primary clinic population: participants were predominantly middle aged (mean age: 49.3 years; SD: 9.1 years); African–American (85%); unmarried (30%); non-smokers (70%); obese (BMI >30 kg/m^2; 70%); and did not consume alcohol (90%). Of the purposive sample, 70% had a history of intimate partner abuse: 5% reported current (past year) physical abuse and 45% reported current psychological abuse. The purposive sample did not differ significantly from women in the original study in sociodemographic or abuse characteristics.

Assessment of PTSD symptoms

PTSD symptoms were measured with the Davidson Trauma Scale (DTS), a 17-item, five-point Likert tool with demonstrated reliability and validity. Scores can range from 0 to 136, with an 83% diagnostic accuracy at scores of 40 or greater (Davidson et al, 1997). The DTS also provides scoring for symptom clusters consistent with the *Diagnostic and Statistics Manual for Mental Disorders IV* (DSM-IV-R; APA, 1995).

Additional assessment of depressive symptoms was accomplished with the 20-item revised Center for Epidemiologic Studies–Depression (CES-D) scale (Eaton et al, 2003). Scores can range from 0 to 60, with scores of 16 or greater indicative of high depressive symptoms (Carpenter et al, 1998; Eaton et al, 1998). A Cronbach's α of 0.94 in the original study indicated acceptable reliability of the CES-D scale (Woods et al, 2005). Cronbach's α coefficient of reliability is a measure of internal consistency of a psychometric instrument and indicates the extent to which a set of test items measures a single variable. It is generally accepted that 0.70 is an acceptable level for new instruments and 0.80 for established instruments.

Women who scored >40 on the DTS were identified as having PTSD symptoms and women with scores >16 on the CES-D were identified as having depressive symptoms. The instruments measure symptoms and do not form a clinical diagnosis. However, both the CES-D and the

DTS have good predictive ability with the DSM-IV-R criteria for diagnoses (Carpenter et al, 1998; Davidson et al, 1997).

Assessment of glycaemic control

A detailed examination of the healthcare provider's progress notes for each clinic visit over the previous year was conducted as part of the original study. The number of visits ranged from 2 to 30 visits per year (mean: 12.4; SD: 7.7). Medical diagnoses, HbA_{1c} levels and current medications were included as part of the review.

Exploratory data analysis, χ^2 and Pearson's correlations were performed with the computer programme SPSS version 14.0 (SPSS Incorporated, Chicago, US) to examine the relationship of PTSD symptoms with HbA_{1c} levels.

Results

All women in this sample reported a history of one to five traumas, with an average of 2.5 traumatic events reported to date (median: 2.0; SD: 1.4). Reported traumatic events included partner violence, life-threatening illness (type 2 diabetes), child abuse and witnessing violence as a child.

DTS scores averaged 36.4 (SD: 33.7). Eight women (40%) scored positive for PTSD symptoms. Scores on the CES-D scale ranged from 0 to 50, with a mean of 37.25 (SD: 16.5). Ten (50%) scored positive for depression. Overall, six (30%) had comorbid PTSD and depressive symptoms. Mental health symptoms did not differ significantly from the original sample.

HbA_{1c} ranged from 5.8% to 16% (mean: 9.3%; SD: 2.45%). Only five women (25%) met the ADA criterion for glycaemic control (HbA_{1c} <7%). The women presenting with good glycaemic control differed significantly from women without good glycaemic control as follows: mean age was greater (54.4 years versus 47.7 years; *P*=0.04), mean depression scores were lower (7.2 versus 19.6; *P*=0.04) and mean PTSD scores were lower (15.2 versus 43.5; *P*=0.05). *Table 2* presents a frequency analysis comparing mental health symptoms by level of glycaemic control.

There was a statistically significant positive association of PTSD symptom scores with HbA_{1c} levels (r=0.59; *P*=0.006) and of depressive symptom scores with HbA_{1c} levels (r=0.560; *P*=0.01). No other potential confounding variables, including age or BMI, were associated with HbA_{1c}. Of particular interest, there was a significant association of the avoidance symptom scores (r=0.686; *P*=0.001) and hyperarousal symptom scores (r=0.478; *P*=0.033), but not intrusion symptom scores (r=0.270; *P*=0.25) with HbA_{1c} (*Table 3*).

Table 2. Mental health symptoms and glycaemic control in primary care women with diabetes: PTSD scores and frequency analysis of symptoms (N=20).

Demographic details		HbA_{1c} <7% (n=5)	HbA_{1c} ≥7% (n=15)
PTSD score:	range mean (SD)	0–47 15.2 (43.5)	0–100 43.5 (34.7)
● Intrusion	range mean (SD)	0–12 4.2 (5.8)	0–35 9.4 (10.8)
● Avoidance	range mean (SD)	0–21 6.2 (9.3)	0–56 17.9 (17.7)
● Hyperarousal	range mean (SD)	0–14 4.8 (6.1)	0–37 16.2 (12.9)
CES-D score:	range mean (SD)	0–14 7.2 (7.3)	0–15 19.6 (17.9)
PTSD symptoms (DTS > 40)	(n [%])	1 (20.0%)	7 (46.7%)
Depressive symptoms (CES-D >16)	(n [%])	1 (20.0%)	9 (60.0%)
PTSD only	(n [%])	1 (20.0%)	3 (20.0%)
Depression only	(n [%])	1 (20.0%)	1 (6.7%)
Comorbid PTSD with depression	(n [%])	0	6 (40.0%)
Suicidal ideation	(n [%])	0	2 (13.2%)
No symptoms of mental health problems	(n [%])	3 (60.0%)	5 (33.3%)

Discussion

Using HbA_{1c} as a surrogate for medication adherence in people with diabetes, our finding of a statistically significant association of increased reporting of PTSD symptoms with higher HbA_{1c} levels suggests a biopsychosocial link in understanding diabetes management (avoidance symptom scores: *P*=0.001; hyperarousal symptom scores: *P*=0.033; *Table 3*). These results are similar to other studies that identified PTSD symptoms and medication nonadherence in individuals who have experienced myocardial infarction, transplant surgery, or are HIV appositive (Dew et al 1999; Safren et al, 2003; Shemesh et al, 2004).

In papers published in 2000 and 2004, Shemesh and colleagues theorised that the avoidance symptom cluster (see *Table 1*) could

Page points

1. A detailed examination of the healthcare provider's progress notes for each clinic visit over the previous year was conducted as part of the original study.
2. All women in this sample reported a history of one to five traumas, with an average of 2.5 traumatic events reported to date.
3. Only five women (25%) met the American Diabetes Association criterion for glycaemic control (HbA_{1c} <7%).

Page points

1. When reported in addition to post-traumatic stress disorder, the authors found a significant association of depressive symptoms with elevated HbA_{1c} levels.
2. This research supports the concept of including a mental health evaluation, particularly for post-traumatic stress disorder and depression.
3. PTSD is typically comorbid with other psychiatric disorders, the most common of which is depression.

Table 3. Association (Pearson rank correlation) of PTSD and depressive symptoms with HbA_{1c}.

	HbA_{1c}	Age	BMI	CES-D	DTS	Intrusion	Avoidance	Hyperarousal
HbA_{1c}	1	-0.032	-0.117	0.560*	0.594**	0.270	0.686**	0.478*
Age		1	-0.498*	0.070	-0.026	-0.131	0.101	-0.071
BMI			1	-0.103	-0.191	-0.211	-0.241	-0.028
CES-D				1	0.776**	0.284	0.747**	0.879**
DTS					1	0.755**	0.952**	0.837**
Intrusion						1	0.654**	0.378
Avoidance							1	0.724**
Hyperarousal								1

* Correlation significant at the 5% level.
** Corelation significant at the 1% level.

potentially explain nonadherent behaviour as a mechanism to avoid being reminded of the illness. We also found a statistically significant association between the avoidance symptom cluster and elevated HbA_{1c} levels. In addition, we found a significant association of hyperarousal symptoms with elevated HbA_{1c}. There is biological plausibility for this relationship (Lavallo, 2004; Gill et al, 2005):

- Hyperarousal symptoms reflect an excess physiological response.
- This exaggerated response is associated with increases in levels of norepinephrine, thyroid hormone and corticotrophin-releasing factor from the hypothalamic–pituitary–adrenal axis.
- These biophysiological changes, which have been documented in people with PTSD, could reduce the body's ability to manage hyperglycaemia.
- Biological factors can act in addition to behavioural avoidance of regimen adherence, but the bio-behavioural interactions are likely to be multifactorial and complex.

When reported in addition to PTSD, we found a significant association of depressive symptoms with elevated HbA_{1c} levels, similar to the findings of Trief and colleagues (2006) who studied male veterans. PTSD is typically comorbid with other psychiatric disorders, the most common of which is depression (Trief et al, 2006). In the study reported here, there was no difference in the glycaemic control status for participants with and without depression-only symptoms (*P*=NS).

There are some limitations to our findings. This secondary data analysis was comprised of a small sample size and HbA_{1c} levels were extracted from medical records rather than being drawn concurrently with the mental health evaluation. However, our findings are strengthened by control of other important extraneous factors, such as BMI, age and other medical conditions that could affect glycaemic control. This is the first known study to examine the association of glycaemic control and PTSD symptoms among women in a primary care setting. Generalisability of the findings is limited by the homogeneity of sample. Participants were primarily African–American, from urban areas, of low-income and uninsured. This study should be repeated in other samples.

Conclusion

Nurses who manage people with diabetes should consider incorporating a holistic biopsychosocial perspective in the plan of care. This research supports the concept of including a mental health evaluation, particularly for PTSD and depression. Nurses should screen for intimate partner violence, as this is a psychosocial risk for PTSD and depression (Campbell, 2002). There are no universally accepted methods of screening for PTSD, depression or other psychiatric comorbidities. However, a four-question screening tool has been developed for women who are victims of partner violence, with good predictive values for depressive symptoms (96%), PTSD symptoms (84%) and suicidal ideation (54%; Houry et al, 2007). People with mental health symptoms should be referred to their primary care provider or a psychiatrist for diagnosis and treatment.

Specific to psychosocial stress in people with diabetes, the Diabetes Distress Scale consists of 17 items that assess emotional burden, regimen-related distress, physician-related distress and

diabetes-related interpersonal distress (Polonsky et al, 2005). Further research is needed to test the effects of screening and intervention on degree of glycaemic control.

Further research is also needed to better understand the biopsychological mechanisms that contribute to glycaemic control, as well as randomised controlled trials to evaluate the incorporation of mental health treatment into a holistic diabetic management plan. ■

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Editor's commentary

This article is unique and interesting; however, I believe that it only confirms what healthcare professionals in the UK have believed for years – that is that having diabetes, regardless of type, is a difficult condition to self manage even when you are feeling at peace with the world.

The authors mention that less than half the people with diabetes in the US achieve target HbA_{1c} levels. When there are other factors that affect behaviour and self-care strategies such as depression or low self esteem, unfortunately, self care seems to suffer. When there are additional stressors such as physical or mental abuse, as mentioned in the article, then a lack of self care manifested by a high HbA_{1c} is not surprising. A person who is in fear of daily physical abuse is not focused on managing their diabetes: I believe this is because they do not worry about long-term complications but focus on the prevention or avoidance of the next act of abuse.

In the UK, as part of the Quality Outcomes Framework introduced within the General Medical Services GMS contract in 2004 and updated in 2006, there are now points attached to depression identification in diabetes that should be included in the annual review process. This is highlighting the fact that depression is a highly under-reported symptom of living with a chronic disease. At least now there is an official prompt to explore the presence of depression, which may uncover the poor reporting of depression among people with diabetes.

As these questions are attached to points and worth money, there is an incentive to ensure that they are asked by the healthcare professional. Unfortunately, there is still a stigma attached to mental health problems and people find it difficult to admit that they are not coping with, or are failing to manage, their diabetes. It is up to all the healthcare professionals working in diabetes care to be sensitive to small signs and symptoms that may indicate depression, and create the right atmosphere in which an individual feels able to divulge coping difficulties.

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