Posttraumatic Stress Disorder in Male Military Veterans With Comorbid Overweight and Obesity: Psychotropic, Antihypertensive, and Metabolic Medications

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Posttraumatic stress disorder (PTSD) is an important syndrome among military veterans. Little has been written about comorbid medical conditions of PTSD, particularly overweight and obesity. We focus on psychotropic and non-psychotropic drugs, their interactions, and metabolic issues most relevant to primary care physicians.

Method: Data from the recently constituted PTSD program at the Department of Veterans Affairs Medical Center in Richmond, Va., were retrospectively reviewed to assess the prevalence and severity of comorbid overweight and obesity in male veterans with PTSD. Also, our database allowed us to correlate various drugs used to treat hypertension, diabetes mellitus, and dyslipidemia with body mass index (BMI).

Results: The mean BMI of 157 veterans with PTSD (DSM-IV criteria) in this sample was in the obese range (30.3 ± 5.6 kg/m^2). The number of drugs a given patient was taking for treatment of hypertension, diabetes mellitus, and dyslipidemia correlated with BMI. Psychotropic drugs associated with weight gain did not explain our findings.

Conclusions: Overweight and obesity among our male veterans with PTSD strikingly exceeded national findings. The administration of psychotropic drugs associated with weight gain did not explain these findings. The number of medications used to treat hypertension, diabetes mellitus, and dyslipidemia correlated significantly with BMI. Rather than these medications explaining the high prevalence of overweight and obesity in our study population, obesity probably worsened these components of the metabolic syndrome, necessitating more aggressive treatment reflected in the high number of drugs prescribed.

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The burden of obesity among military veterans was recently documented by Das et al.[1] in a study population of 1,710,032 men and 93,290 women. These investigators found that among men, 73.0% were at least overweight, 32.9% were classified as obese, and 3.3% were found to be morbidly obese. Among women, 68.4% were at least overweight, 37.4% were classified as obese, and 6.0% were morbidly obese. Military veterans were not separated as to whether they did or did not have posttraumatic stress disorder (PTSD).

Military veterans with PTSD may receive a variety of psychotropic medications.[2,3] Military veterans with psychiatric disorders are at increased risk for obesity and other features of the metabolic syndrome.[4] Primary care physicians may find themselves challenged by the multiple medications prescribed to military veterans with PTSD plus metabolic disorders. The discovery of pervasive overweight and obesity as determined by body mass index (BMI) measurements among military veterans in our recently inaugurated PTSD program provided us the opportunity to assess BMI and its relationship with psychotropic medications and medications used to treat hypertension, diabetes mellitus, and dyslipidemia. Our observations form the body of this report.

METHOD

By late December 2004, the newly inaugurated Richmond, Va., PTSD program had enlisted over 200 veterans

Table 1. Relative Weight Changes With Psychotropic Drugs and Other Central Nervous System Drugs[a]

–0.5	0	+0.5	+1	+1.5	+2
Bupropion (Wellbutrin and others)	Aripiprazole (Abilify)	Amitriptyline	Chlorpromazine (Thorazine, Sonazine, and others)	Divalproex (Depakote)	Olanzapine (Zyprexa)
Methylphenidate (Ritalin, Metadate, and others)	Benzodiazepines	Imipramine (Tofranil and others)	Gabapentin (Neurontin and others)	Lithium (Lithobid, Eskalith, and others)	
SSRI	Buspirone (BuSpar and others)	Mirtazapine (Remeron and others)	Fluphenazine (Prolixin and others)		
Fluoxetine (Prozac and others)	Carbamazepine (Carbatrol, Equetro, and others)		Quetiapine (Seroquel)		
Topiramate (Topamax)	Phenobarbital		Risperidone (Risperdal)		
	Phenytoin (Dilantin, Phenytek, and others)				
	Nortriptyline (Aventyl, Pamelor, and others)				
	SSRIs				
	Citalopram (Celexa and others)				
	Escitalopram (Lexapro)				
	Fluvoxamine				
	Paroxetine (Paxil, Pexeva, and others)				
	Sertraline (Zoloft)				
	Trazodone (Desyrel and others)				
	Venlafaxine (Effexor)				
	Zolpidem (Ambien)				

[a]The relative weight changes were determined using principles previously reported by Vieweg et al.[5] The authors used nonparametric principles to develop this scoring system. The intervals between numeric values are arbitrary, as are the values themselves.
Abbreviation: SSRI = selective serotonin reuptake inhibitor.

who were referred with clinical features of PTSD, subsequently met DSM-IV criteria for PTSD, and carried PTSD as their primary psychiatric diagnosis. Complete records were available for 170 veterans. Because nonblack, nonwhite veterans and female veterans constituted only a small fraction of our study population, we focused on 157 black and white male veterans. Variables assessed included (1) age, (2) race, (3) height, (4) weight, and (5) current medications. From the height and weight measurements, we calculated BMI (kg/m^2).

The above data were collected as a part of a standard evaluation and were not part of any prospective research. The primary purpose of the database was to develop individualized clinical treatment. Thus, the data tabulation and analyses were not subject to Institutional Review Board review.

Table 1 lists psychotropic drugs and other central nervous system (CNS) drugs and their relative association with weight gain. This scoring system was derived from an earlier study,[5] our clinical experience, an extensive review of the literature,[6–31] and the recent consensus statement on antipsychotic drugs, obesity, and diabetes developed by the American Diabetes Association, American Psychiatric Association, American Association of Clinical Endocrinologists, and North American Association for the Study of Obesity.[32]

Our scoring system employed nonparametric principles. There were 6 possible scores with a natural order (ordinal data). However, there were no clear-cut "units" separating each possible score.

RESULTS

Age and Race

The mean ± SD age of the 91 black male veterans was 55.8 ± 7.7 years, and the mean age of the 66 white male veterans was 57.2 ± 7.7 years. These age differences were not statistically significant ($t = 1.155$, $df = 155$, $p = .250$). We undertook no further analysis of age according to race.

BMI and Race

The mean BMI of the 91 black male veterans was 29.6 ± 5.9 kg/m^2, and the mean BMI of the 66 white male veterans was 31.1 ± 5.1 kg/m^2. These BMI differences did not reach a level of statistical significance ($t = 1.609$, $df = 155$, $p = .110$). We undertook no further analysis of BMI according to race.

BMI and Decade of Life

Differences in BMI by decade of life (Table 2a) did not reach statistical significance ($p = .571$). Most (67.5%) of our veterans were in the age range of 50 to 59 years, consistent with the fact that Vietnam veterans dominated our study population.

BMI Groupings

BMI was in the normal range (< 25 kg/m^2) for 24 veterans (15.3%). There were 60 veterans (38.2%) in the overweight range (≥ 25 kg/m^2 to < 30 kg/m^2), 63 veterans (40.1%) in the obese range (≥ 30 kg/m^2 to < 40 kg/m^2),

Table 2a. Body Mass Index (BMI) by Decade of Life Among 157 Male Veterans With Posttraumatic Stress Disorder[a]

Age, y[b]	BMI,[c] kg/m^2
20–29 (N = 1)	26.7
30–39 (N = 4)	29.7 ± 3.9
40–49 (N = 14)	29.0 ± 3.5
50–59 (N = 106)	30.8 ± 5.9
60–69 (N = 24)	29.6 ± 5.7
70–79 (N = 7)	27.1 ± 3.8
80–89 (N = 1)	30.1
Total (N = 157)	30.3 ± 5.6

[a]Analysis of variance: F = 0.800, df = 6, p = .571.
[b]The youngest veteran was 26 years old, and the oldest veteran was 81 years old.
[c]Values shown as mean or mean ± SD. The smallest BMI was 18.2 kg/m^2, and the largest BMI was 45.7 kg/m^2.

Table 2b. Body Mass Index (BMI) for 157 Male Veterans With Posttraumatic Stress Disorder Categorized as Normal Weight, Overweight, Obese, and Morbidly Obese[a]

Category	N	%
Normal weight (< 25 kg/m^2)	24	15.3
Overweight (≥ 25 to < 30 kg/m^2)	60	38.2
Obese (≥ 30 to < 40 kg/m^2)	63	40.1
Morbidly obese (≥ 40 kg/m^2)	10	6.4

[a]The mean ± SD BMI for the overall sample was 30.3 ± 5.6 kg/m^2.

and 10 veterans (6.4%) in the morbidly obese range (≥ 40 kg/m^2) (Table 2b). That is, 84.7% of the black and white male veterans were overweight, obese, or morbidly obese.

Medications

Psychotropic and other CNS drugs. Table 3 lists medications classified as psychotropic and other CNS drugs. Psychotropic agents were used to treat anxiety, depression, and psychosis-like symptoms. Other CNS drugs were used to treat seizures and pain. Some of these other CNS medications also had favorable effects on mood dysregulation.

Antihypertensive drugs. Table 4 lists medications used to treat hypertension. We divided them broadly into antihypertensives and diuretics. We separated these medications from other cardiovascular drugs that included amiodarone, digoxin, and isosorbide mononitrate and isosorbide dinitrate.

Drugs for diabetes mellitus and dyslipidemia. Table 5 lists medications used to treat diabetes mellitus and dyslipidemia. We created an additional category of hormones (insulin, levothyroxine, prednisone, and testosterone) but did not list those specific medications.

Other medications. Table 6 lists other drugs by general category. The Department of Veterans Affairs uses a national formulary so that the same medications are available to all facilities. We did not include topical drugs, antimicrobials, short-term treatments, aspirin, acetaminophen, aspirin/acetaminophen, non–narcotic-

Table 3. Psychotropic and Other Central Nervous System (CNS) Medications Taken by 157 Patients With PTSD and Number of Patients Who Received Each Drug

Medication	N
Psychotropics	
Antidepressants	
SSRIs	
Citalopram	27
Escitalopram	2
Fluoxetine	16
Fluvoxamine	1
Paroxetine	10
Sertraline	28
SNRI	
Venlafaxine	7
Dopamine and norepinephrine reuptake blocker	
Bupropion	17
Stimulates serotonin and norepinephrine release	
Mirtazapine	6
5-HT$_2$ antagonist	
Trazodone	58
TCAs	
Amitriptyline	8
Imipramine	1
Nortriptyline	3
Antipsychotics	
First-generation	
Chlorpromazine	1
Fluphenazine	1
Second-generation	
Aripiprazole	3
Olanzapine	7
Quatrain	54
Risperidone	12
Anxiolytics and hypnotics	
Benzodiazepines	
Alprazolam	8
Clonazepam	13
Diazepam	2
Lorazepam	7
Temazepam	4
5-HT$_{1A}$ agonist	
Buspirone	5
Non-benzodiazepine hypnotic	
Zolpidem	1
Mood stabilizers	
Carbamazepine	2
Divalproex	9
Lithium	1
Stimulant	
Dopamine agonist	
Methylphenidate	1
Anticholinergic	
Benztropine	1
Other CNS drugs	
Gabapentin	12
Phenobarbital	2
Phenytoin	2
Topiramate	1

Abbreviations: 5-HT = serotonin, SNRI = serotonin-norepinephrine reuptake inhibitor, SSRI = selective serotonin reuptake inhibitor, TCA = tricyclic antidepressant.

Table 4. Antihypertensive Drugs, Diuretics, and Other Cardiovascular Medications Taken by 157 Patients With Posttraumatic Stress Disorder and Number of Patients Who Received Each Drug

Medication	N
Antihypertensive Agents	
ACE inhibitors	
Enalapril	1
Fosinopril	18
Lisinopril	38
α_1-Antagonist	
Terazosin	19
Angiotensin II receptor antagonist	
Irbesartan	8
β-Blockers	
Propranolol	3
Atenolol	25
Metoprolol	13
Calcium channel blockers	
Amlodipine	4
Diltiazem	3
Felodipine	16
Nifedipine	5
Verapamil	4
Central α agonist	
Clonidine	2
Diuretics	
HCTZ	37
Furosemide	10
Spironolactone	1
Other Cardiovascular Drugs	7

Abbreviations: ACE = angiotensin-converting enzyme, HCTZ = hydrochlorothiazide.

Table 5. Medications for Diabetes Mellitus, Medications for Dyslipidemia, and Hormones Taken by 157 Patients With Posttraumatic Stress Disorder and Number of Patients Who Received Each Drug

Medication	N
Diabetes Mellitus	
Antidiabetic	
Acarbose	1
Glipizide	13
Glyburide	6
Metformin	27
Rosiglitazone	2
Fibrate	
Fenofibrate	5
Dyslipidemia	
Anticholesterol	
Colestipol	1
Blocks triglyceride production	
Gemfibrozil	9
Omega-3	
Fish oil	18
Statin	
Atorvastatin	6
Ezetimibe	5
Fluvastatin	6
Lovastatin	28
Simvastatin	23
Vitamin B_3	
Niacin	9
Hormones	19

containing drugs, multivitamins, sildenafil, and electrolyte replacement.

Medication Score and BMI

Table 7 lists drugs and drug scores correlated with BMI. The total number of drugs used to treat hypertension and those used to treat diabetes mellitus and dyslipidemia best correlated with BMI ($r = 0.461$, $p < .0001$). Neither second-generation antipsychotic drug scores nor psychotropic drug scores plus other CNS drug scores correlated with BMI. That is, psychotropic drug–induced weight gain did not seem to be a factor in the high prevalence of overweight and obesity among our study subjects.

DISCUSSION

The mean BMI for the study population of male military veterans was 30.3 ± 5.6 kg/m^2, and this did not vary by decade of life (Table 2). Thus, the typical patient was obese. Specifically, 38.2% of the veterans were overweight, 40.1% were obese, and 6.4% were morbidly obese. The most recent (1999-2000) National Health and Nutrition Examination Survey (NHANES) showed that among U.S. adults, the prevalence of overweight (34.0%) and obesity (30.5%) together reached a new high of 64.5%.[33] Overweight among our veterans exceeded national figures by 4.2%, and obesity (obesity plus morbid obesity) exceeded national figures by 16.0%. Thus, combined overweight and obesity prevalence in our study sample exceed U.S. adult findings by 20%. Age, race, and decade of life appeared to have little effect on our findings even though the sixth decade of life is associated with the highest prevalence of obesity at a national level[34] and veterans in this age group made up 67.5% of our study population (Table 2).

Morbid Obesity

The prevalence of morbid obesity in the United States is increasing much faster than that of nonmorbid obesity,[35] and with morbid obesity come the most severe health consequences.[36] Morbid obesity increased from 2.9% to 4.7% among U.S. adults from the 1988 through 1994 NHANES to the 1999 through 2000 NHANES.[33] Of our 157 military veterans, 6.4% were morbidly obese (≥ 40 kg/m^2).The greater the degree of obesity, the greater the number of excess deaths[37] and years of life lost.[38] Also, severely obese patients, especially younger women with a poor body image, are at high risk for depression.[39] Finally, patients with morbid obesity are twice as likely as normal-weight adults to incur any health care expenditure.[40]

Our Observations Compared With the Literature

Arterburn et al.,[41] in a quality-of-life survey, analyzed cross-sectional data that included BMI estimates among

Table 6. Categories of Other Drug Medications Taken by 157 Patients With Posttraumatic Stress Disorder and Number of Patients Who Received Drugs From Each Category

Category	N
Analgesics	63
Anti-inflammatory drugs	29
Gastrointestinal drugs	54
Narcotics	21
Other drugs	62

Table 7. Drugs and Number of Drugs Prescribed Correlated With Body Mass Index (BMI) for 157 Male Veterans With Posttraumatic Stress Disorder

Count	Mean ± SD	Minimum/ Maximum	Correlation With BMI
Numeric drug sums[a]			
(A) All drugs	6.4 ± 3.8	0/19	r = 0.357, p < .0001
(B) Antihypertensives and diuretics	1.3 ± 1.3	0/5	r = 0.450, p < .0001
(C) Diabetes and lipid drugs	1.1 ± 1.4	0/7	r = 0.314, p < .0001
(D) Total of (B) and (C)	2.4 ± 2.2	0/11	r = 0.461, p < .0001
Drug score sums[b]			
Antipsychotic drugs	0.5 ± 0.6	0/3	r = 0.097, p = .224
Psychotropics and other CNS drugs	0.7 ± 0.9	–0.5/3.5	r = 0.002, p = .985

[a]Numeric drug sums represent the actual number of drugs prescribed.
[b]Drug score sums for antipsychotic drugs represent scoring systems devised for second-generation antipsychotic drugs using relative scoring of "2" for clozapine and olanzapine, "1" for quetiapine and risperidone, and "0" for aripiprazole and ziprasidone according to the relative weighting outlined in the Consensus Development Conference on Antipsychotic Drugs and Obesity and Diabetes.[32] Drug score sums for psychotropics and other CNS drugs derive from our earlier study of relative risk of drug-induced weight gain for psychotropic drugs.[5] Specific drug scores appear in Table 1.
Abbreviation: CNS = central nervous system.

15,857 veterans enrolled in the General Internal Medicine Clinics at 7 Department of Veterans Affairs Medical Centers, including the one in Richmond, Va. On the basis of the age distribution in that study,[41] veterans were older than our study population, consistent with a larger proportion of World War II veterans. Arterburn et al.,[41] using telephone-obtained height and weight data, found that 43.1% of their subjects were overweight and 28.4% were obese. The number of veterans overweight and obese in their study (71.5%) exceeded expected values (64.5%) based on current national surveys of the U.S. population.[33] However, veterans in the study reported by Arterburn et al.[41] did not reach the prevalence of overweight and obesity found in our study (84.7%) even though that study included veterans from the Richmond catchment area. The authors did not look at the prevalence of PTSD in their veteran population.[41]

David et al.[42] assessed comorbid physical illnesses among veterans with PTSD and compared those findings with those of veterans with alcohol dependence. The authors reported a total of 74 medical conditions among their 55 PTSD veterans (mean age = 49.7 years). The mean ± SD BMI for their PTSD veterans[42] was 30.1 ± 6.6 kg/m^2 compared with our value of 30.3 ± 5.6 kg/m^2. Compared with our obesity prevalence of 46.5%, 36% of their veterans were obese.

Recently, Das et al.[1] reported that obesity was greatest (39.9%) in the age group 50 to 59 years among 1,710,032 military veterans. This figure divided into 34.6% for those obese and 5.3% for those morbidly obese. Among our military veterans in all age groups, 40.1% were obese (≥ 30 kg/m^2 to < 40 kg/m^2) and 6.4% were morbidly obese (≥ 40 kg/m^2). Thus, our male military veterans with PTSD who were cared for by the Department of Veteran Affairs (DVA) tended to have more of a problem with obesity than the general population of male military veterans receiving care from DVA.

Antipsychotic Drugs and Weight Gain

Recently, emphasis has been placed on antipsychotic drug–associated weight gain—particularly weight gained during treatment with second-generation agents.[32] Among the second-generation antipsychotic drugs, clozapine and olanzapine are most commonly associated with weight gain, risperidone and quetiapine are in the middle, and ziprasidone and aripiprazole are basically weight neutral.[32] Among our study patients, administration of neither psychotropic drugs nor second-generation antipsychotic drugs contributed to the high prevalence of overweight and obesity. Table 8 outlines current parameters for psychiatrists to monitor when administering these agents.[32] The same principles, of course, would apply to other clinicians prescribing these drugs. Despite the lack of an association between BMI and psychotropic drug administration in our study, given the strength of the evidence from the literature and the pervasiveness of overweight and obesity and their medical complications among our male PTSD veterans, these monitoring parameters seem to be the bare minimum when prescribing antipsychotic drugs for patients with PTSD.

CONCLUSIONS

Overweight and obesity among our male veterans with PTSD strikingly exceeded national findings. The administration of psychotropic drugs associated with weight gain did not explain these findings. The number of medications used to treat hypertension, diabetes mellitus, and dyslipidemia correlated significantly with BMI. Rather than these medications explaining the high prevalence of overweight and obesity in our study population, obesity probably worsened these components of the metabolic syndrome, necessitating more aggressive treatment reflected in the high number of drugs prescribed.

Table 8. Recommended Monitoring of Patients Receiving Second-Generation Antipsychotic Drugs[a]

Interval	Personal/Family History	Weight (BMI)	Waist Circumference	Blood Pressure	Fasting Plasma Glucose	Fasting Lipids
Baseline	✓	✓	✓	✓	✓	✓
4 Weeks		✓				
8 Weeks		✓				
12 Weeks		✓		✓	✓	✓
Quarterly		✓				
Annually	✓		✓	✓	✓	
Every 5 years						✓

[a]Adapted with permission from reference 32.
Abbreviation: BMI = body mass index.

On the basis of our observations, treatment of PTSD among male military veterans should address comorbid medical conditions as well as the clinical features of PTSD. Additional studies are needed to better explain our findings.

Drug names: acarbose (Precose), alprazolam (Xanax, Niravam, and others), amiodarone (Cordarone, Pacerone, and others), amlodipine (Norvasc), aripiprazole (Abilify), atenolol (Tenormin and others), atorvastatin (Lipitor), benztropine (Cogentin and others), bupropion (Wellbutrin and others), buspirone (BuSpar and others), carbamazepine (Carbatrol, Equetro, and others), chlorpromazine (Thorazine, Sonazine, and others), citalopram (Celexa and others), clonazepam (Klonopin and others), clonidine (Duraclon, Catapres, and others), clozapine (Clozaril, FazaClo, and others), colestipol (Colestid), diazepam (Valium and others), digoxin (Lanoxicaps, Lanoxin, and others), diltiazem (Taztia, Cartia, and others), divalproex (Depakote), enalapril (Vasotec and others), escitalopram (Lexapro), ezetimibe (Zetia), felodipine (Plendil and others), fenofibrate (Antara, Tricor, and others), fluoxetine (Prozac and others), fluphenazine (Prolixin and others), fluvastatin (Lescol), fosinopril (Monopril and others), furosemide (Lasix and others), gabapentin (Neurontin and others), gemfibrozil (Lopid and others), glipizide (Glucotrol and others), glyburide (Diabeta, Micronase, and others), hydrochlorothiazide (Microzide, Oretic, and others), imipramine (Tofranil and others), irbesartan (Avapro), isosorbide dinitrate (Dilatrate, Isordil, and others), isosorbide mononitrate (Imdur, Ismo, and others), levothyroxine (Synthroid, Levo-T, and others), lisinopril (Zestril, Prinivil, and others), lithium (Lithobid, Eskalith, and others), lorazepam (Ativan and others), lovastatin (Altoprev, Mevacor, and others), metformin (Riomet, Fortamet, and others), methylphenidate (Ritalin, Metadate, and others), metoprolol (Toprol, Lopressor, and others), mirtazapine (Remeron and others), niacin (Niaspan, Niacor, and others), nortriptyline (Aventyl, Pamelor, and others), olanzapine (Zyprexa), paroxetine (Paxil, Pexeva, and others), phenytoin (Dilantin, Phenytek, and others), propranolol (Innopran, Inderal, and others), quetiapine (Seroquel), risperidone (Risperdal), rosiglitazone (Avandia), sertraline (Zoloft), sildenafil (Rivatio and Viagra), simvastatin (Zocor), spironolactone (Aldactone and others), temazepam (Restoril and others), terazosin (Hytrin and others), testosterone (Androderm, Testim, and others), topiramate (Topamax), trazodone (Desyrel and others), venlafaxine (Effexor), verapamil (Verelan, Isoptin, and others), ziprasidone (Geodon), zolpidem (Ambien).

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