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Comprehensive Sleep Apnea Screening in Veterans with Posttraumatic Stress Disorder

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The manuscript reports findings from implementing an evidence-based practice project

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Abstract

Objectives: Recent studies have shown a higher prevalence of sleep apnea in veterans with Posttraumatic Stress Disorder (PTSD). It is estimated that 69 to 83% of veterans have Obstructive Sleep Apnea (OSA) while 80 to 90% are undiagnosed or untreated. Untreated OSA can lead to severe chronic medical conditions as well as impairment of neurocognitive and fear extinction processing potentially decreasing responsiveness to trauma focused therapy. Despite the widespread dissemination of knowledge regarding the negative effects of OSA, many veterans are not screened. The goal of this project is to increase the rate of identifying veterans who are high-risk for OSA.

Methods: The Epworth Sleepiness Scale (ESS) and Berlin Questionnaire (BQ) were administered to veterans who presented for PTSD treatment over a two-month period. High-risk veterans were referred for a sleep study and treatment if diagnosed with OSA. Veterans with a prior diagnosis of OSA were screened to identify undertreatment.

Results: Increase in identifying high-risk OSA from 5.5% to 71.4%, with an overall increase in the diagnostic rate from 22.2% to 78.3%. In veterans previously diagnosed with OSA, 90.1% were undertreated.

Conclusions: Implementing a comprehensive screening process significantly improved the identification of veterans who are high-risk for OSA compared to usual practice. Identification and treatment of OSA is associated with an improvement in PTSD symptoms. Due to the potential effects of untreated OSA on psychiatric and medical conditions this screening process is applicable to both mental health and primary care settings.

Keywords: veterans, sleep apnea screening, PTSD, posttraumatic stress disorder

Brief Summary

The majority of veterans with posttraumatic stress disorder are not screened for obstructive sleep apnea despite the overwhelming evidence indicating a higher rate of prevalence compared to the general population. The aim of this project is to compare an evidence based, sleep apnea screening process to usual practice. Implementing an effective and comprehensive screening process can significantly reduce the rate of veterans with undiagnosed obstructive sleep apnea. Treatment of obstructive sleep apnea not only decreases the risk of developing several chronic conditions, but even a relatively short period of time on a continuous positive air pressure device has been shown to improve neurocognitive functioning and reduce the severity if posttraumatic stress disorder symptoms.

Comprehensive Sleep Apnea Screening in Veterans with Posttraumatic Stress Disorder

Introduction

Over the past several years there has been growing concern about the prevalence of sleep disorders in the veteran population. In 2016 the National Veteran Sleep Disorder Study, a serial cross-sectional review of more than nine million medical health records, found that veterans had a six-fold relative increase in the prevalence of total sleep disorders between 2000 and 2010. [1] This study also indicated veterans with PTSD were found to have significantly higher rates of OSA compared to the general population. In a series of studies focusing on sexual assault and crime victims with PTSD in the general population, the diagnostic rate for OSA as high as 50%.[2,3.] In the veteran population however, studies indicate a diagnostic rate of 67 to 83%. [4-6]

This vulnerability may be due to several different factors. Service members are often subjected to irregular sleep/wake schedules and rotating shifts, deploy to regions multiple time zones away, and endure severe amounts of stress during combat related missions. Many veterans have been exposed to significant and often repeated traumatic experiences that cannot be dealt with immediately during combat operations because it could impede the mental readiness needed to complete the mission. Service members sustain higher rates of severe physical and mental health injuries that lead to premature separation from active duty and assimilation back into the civilian sector may cause significant psychologic stress for many service members. These factors can lead to chronic residual sleep disturbances and increases the risk of developing sleep disorders like OSA. [1,2]

Left untreated, OSA can lead to the development of costly chronic medical conditions like diabetes, cardiovascular disease, stroke, hypertension and cancer. Untreated OSA can also lead to neurocognitive deficits that may worsen the severity of PTSD symptoms. [7,8] Between

80% to 90% of veterans with OSA remain undiagnosed despite the widespread dissemination of knowledge regarding the detrimental effects of untreated OSA and an evidence-based screening process has yet to be implemented by the Veterans Affairs (VA). [1]

To select an appropriate screening process, it is important to understand the theory and pathophysiology indicating the bidirectional relational between PTSD and OSA which was first suggested in 2002 by Krakow and colleagues. Due to high sympathetic tone and problems with autonomic regulation, PTSD induced sleep fragmentations leads to upper airway collapsibility and sleep breathing events (upper airway resistance, hypopneas, or apneas). These breathing events induce further sleep fragmentation, thus producing a vicious cycle where each condition contributes to comorbidity.[9] Two additional studies have also proposed this theory indicating neuromuscular changes in the upper airway occur due to stress associated factors and sleep fragmentation. [10,11.] Krakow also noted a pathophysiologic link associating PTSD and OSA with dysfunction of the HPA axis and alterations in the hippocampus.

Due to frequent OSA related sleep arousals, alterations in REM and slow-wave sleep are detrimental to PTSD recovery because both of these sleep stages are particularly important for memory consolidation of emotional experiences.[12] Individuals with OSA will display longer reaction times in tasks requiring sustained attention, worsening other aspects of cognitive deficits such as impairments in executive function and episodic memory. Deficits in most aspects of executive functioning are characterized by decreased processing speed, increased perseverative responses or behaviors, impulsivity, and difficulty with problem solving.[13] This further activation of the HPA axis and autonomic dysregulation is also part of the vicious cycle contributing to comorbidity.[8] Based on these pathophysiologic effects, veterans with PTSD may present with atypical risk factors compared to the general population. Typical risk factors for OSA include

obesity, aging, male sex, and presence of excessive daytime somnolence.[14] In contrast, veterans have shown a more equal distribution of body mass index (BMI), higher rates in females with PTSD (50%), lower average age range (30 to 50 years old), and daytime somnolence may be masked by PTSD related hyperarousal symptoms causing psychomotor agitation stemming.[1,15]

This evidence indicates a comprehensive screening process is most appropriate in this high-risk population for several reasons: a) the overall high prevalence rate of OSA in veterans with PTSD, b) the potential to present with atypical risk factors for OSA, and c) the severe clinical implications related to untreated OSA. An additional reason that is not found in the research but worth considering is many veterans presenting for PTSD treatment may not be screened for OSA if interested in psychotherapy but not a psychiatric evaluation. Comprehensive screening also identifies veterans who are previously diagnosed with OSA but may be undertreated which includes untreated, noncompliance, or a subtherapeutic response to treatment. Research studies in this patient population have utilized the Epworth Sleepiness Scale (ESS) and the Berlin Questionnaire (BQ) screening tools to identify high-risk OSA. The ESS is considered the gold standard but because it is based on subjective scoring of daytime somnolence that may be masked by hyperarousal, studies have also used the Berlin Questionnaire (BQ) because it is displaying equal sensitivity to the ESS in this patient population and focuses on different risk factors including fatigue.[16]

Methods

Design:

The revised Iowa Model[18] was utilized as the framework to identify opportunities to evaluate and infuse research findings into evidence-based practice. Appropriate University of San Diego and VA Institutional Review Board approvals were obtained. A team comprising of

the clinical leadership from the PTSD clinic, sleep medicine clinic, and PTSD research department collaborated in developing the strategic plan.

Sample:

This project included a convenience sample of 48 veterans who presented at an outpatient PTSD clinic seeking initial treatment. The age range was 26 to 72 years old. There were 39 males and 7 females. Veterans were referred to the PTSD clinic by the intake team or another mental health clinic after confirming a diagnosis of PTSD.

Variables and measurement:

Epworth Sleepiness Score (ESS)

The ESS is a screening tool that asks subjects to rate how likely they are have dozed in eight specific situations or activities that are commonly met in daily life. The chance of dozing is rated on a scale of 0 (none) to 3 (high). The sum of eight items can range between 0 and 24. A score above 10 is considered positive for excessive daytime somnolence and high risk for OSA.

Berlin Questionnaire (BQ)

The BQ is an 11- item screening tool used to assess risk for OSA. Items are clustered into three categories: 1) presence and frequency of snoring behavior; 2) wake time sleepiness or fatigue; and 3) presence of obesity or hypertension. A minimum of two categories each with a positive score is considered high risk for OSA.

Data collection

Veterans completed a comprehensive intake packet at their initial visit at the PTSD clinic, regardless whether they were seeking psychotherapy or pharmacologic treatment. The results were reviewed by a psychiatric provider and veterans identified as high risk for OSA (positive score on either screening tool) were referred to the sleep medicine clinic for a sleep study. The

remaining positive high-risk screenings were contacted and asked if they would consent for a sleep study for further evaluation and treatment. Veterans who were previously diagnosed with OSA were included in the screening to help identify those who may have been untreated or undertreated (partially compliant or not well controlled with current pressure settings).

Results

Preexisting data was difficult to ascertain specifically to the PTSD clinic because the data has been reported on an organizational and national level. A manual review of the month prior to the project trial, showed there were a total of 18 new patients seen in the PTSD clinic. Four veterans were previously diagnosed with OSA. From the remaining sample only one veteran was referred for a sleep study. There was no documentation in the veterans' records whether OSA was performed.

The trial was done over a two-month period and consisted of veterans who were referred to the PTSD clinic either by the mental health intake team or by one of the other mental health clinics. From the sample, 11 had preexisting diagnosis of OSA and 10 of those veterans were undertreated. In the remaining sample 25 veterans were identified as high-risk for OSA with a positive screening on both tools in each case, there was no differentiation between the ESS and the BQ in this sample. Each veteran that screened positive was referred to the sleep medicine clinic for an at-home-sleep study. Upon completion of the sleep studies, 21 veterans were diagnosed with sleep apnea. Overall, the identification of veterans who are high risk OSA increased from 5.5% to 71.4% and an increase in the OSA diagnostic rate from 22.2% to 78.3%. The screening also identified that 90.9% of veterans previously diagnosed with OSA were undertreated.

Discussion

A comprehensive screening process to identify high risk OSA in veterans with PTSD has not been implemented in the VA setting despite the high rate of prevalence, widespread knowledge of the detrimental effects of untreated OSA, and evidence of valid secondary prevention screening tools. In comparison to the usual standard of care, implementation of the comprehensive screening process utilizing the ESS and BQ was superior in identifying veterans who are high risk for OSA.

Based on the emerging theories explaining the bidirectional relationship and the pathophysiology contributing to comorbidity, the clinical implications of screening and treating OSA are significant. Addressing PTSD sleep fragmentation and OSA concurrently will lead to a reduction in PTSD symptom severity and the risk of severe chronic medical conditions while improving quality of life. Identifying and treating high-risk OSA also represents a significant reduction in healthcare costs for the VA. When comparing the costs associated with testing and treating OSA compared to the annual healthcare costs incurred due to untreated OSA, the return of investment for the VA facility is approximately 875%.

There are possible limitations identified by this project that may explain why a comprehensive screening process has not been implemented yet at the VA facility. While the validity of both the ESS and BQ has been well established for the general population, they have not been validated specifically in comorbid PTSD populations yet. To reduce this potential limitation, both tools were utilized for this project due to the minimal extra time needed to complete the questionnaire. In this sample the results were equivocal and this is an area that would need further data.

Despite these limitations, the implementation of this screening process far exceeded the results from the current standard of care and can be considered best practice. This screening process also indicated practicality in any mental health clinic setting. It is also advisable to consider implementing the screening process in the primary care setting since many veterans with PTSD my not seek out any mental health services but follow up with their primary care provider.

Abbreviations

BQ – Berlin Questionnaire

ESS – Epworth Sleepiness Scale

HPA – hypothalamus pituitary adrenal

OSA – obstructive sleep apnea

PTSD – posttraumatic stress disorder

REM – rapid eye movement

VA – Veterans Affairs

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Tables

Table 1

Total Costs of Service

	Item	Cost
Required personnel		
	Sleep physician (medical director 0.25 FTE)	$55,907
	Nurse unit manager (1.0 FTE)	$96,905
Variable personnel		
	Sleep medicine physician	$223,626
	Sleep medicine nurse	$96,905
	Respiratory therapist	$81,996
	Unattended PSG scorer	
	Office assistant	
Supplies		
	Sleep monitoring devices (per 1000 studies)	$120,000
Total cost		$649,248

Note: Annual costs include locality pay and 30% fringe benefit costs

Table 2

Cost Benefit Analysis

Item	Amount
Total costs of service	$649,248 per year
Cost	$650 per patient
Healthcare savings	$6,336 annually per patient
Cost benefit analysis	$9.75 savings /$1 invested
Return of investment	875%