Current Psychiatry Research and Reviews, 2019, *15*, 44-48

REVIEW ARTICLE

Combat Military Personnel and Selective Risk Factors for the Development of Dementias - A Review

Blanka Klimova[1], Petra Maresova[2] and Kamil Kuca[3,*]

[1]*Department of Neurology, University Hospital Hradec Kralove, Hradec Kralove, Czech Republic;* [2]*Faculty of Informatics and Management, University of Hradec Kralove, Rokitanského 62, 50003, Hradec Kralove, Czech Republic;* [3]*Philosophical Faculty, University of Hradec Kralove, Rokitanského 62, 50003, Hradec Kralove, Czech Republic*

ARTICLE HISTORY

Received: September 28, 2018
Revised: December 28, 2018
Accepted: December 28, 2018

DOI:
10.2174/1573400515666190114155451

Abstract: Due to the growth of life expectancies and the increasing number of elderly population all over the world, there is a risk of growth of aging diseases such as dementia. Recent research studies also indicate that there will be a growing number of military veterans who will be affected by dementia, already at the age of 55+ years. In the case of combat military personnel, the most common dementias are Alzheimer's disease and vascular dementia. These two dementias are very similar because their main symptoms are the same. The purpose of this review is to explore two main risk factors influencing the development of the dementias. These include posttraumatic stress disorder (PTSD) and traumatic brain injury (TBI). Furthermore, the authors of this study focus on the exploration of the treatment of PTSD and TBI in order to delay the development of dementias among combat military personnel.

For the purpose of this study, a method of literature review of available sources exploring these two main risk factors of dementia among combat military personnel was used. Based on the evaluation of these literature sources, possibilities of pharmacological and non-pharmacological approaches to the treatment and care of these people were described.

Keywords: Soldiers, dementias, posttraumatic stress disorder, traumatic brain injury, treatment, Alzheimer's disease.

1. INTRODUCTION

Due to the growth of life expectancies and the increasing number of elderly population all over the world, there is a risk of growth of aging diseases such as dementia. In fact, after the age of 65+ years, the risk of dementia is assumed to double every five years [1]. Currently, there are more than 44 million people suffering from this disease, and by 2050, the number of affected people should be three times higher [2]. Recent research studies [3, 4] also indicate that there will be a growing number of military veterans who will be affected by dementia. They also reveal that the incidence of dementia with this group develops earlier, already at the age of 55+ years.

Dementia is a neurodegenerative disease which manifests itself by significant memory loss, orientation difficulties, communication disorders, worsening decision-making process, depression, apathy, agitation, behavioral changes, confusion, or sleeping difficulties [5, 6]. Dementia is caused by several reasons such as an impediment of blood flow which circulates into the brain, multiple small strokes, malnutrition, brain tumors, metabolic diseases or trauma. At present, the most frequent type of dementia is Alzheimer's disease which covers 70% of all dementia cases [7].

In the case of soldiers, the most common dementias are Alzheimer's disease (AD) and vascular dementia (VD) [3]. These two dementias are very similar because their main symptoms are the same. The symptoms include deterioration of cognitive functions such as loss of memory. Other symptoms comprise recalling new events, recognizing familiar objects, thinking difficulties, impaired communication, organizational difficulties, learning new things, or motor coordination [8]. In comparison with AD, vascular dementia results from the cerebrovascular disease and it usually starts a bit earlier than AD, when people are 60 years old. It is most frequently caused by small strokes that affect the blood flow into the brain. In addition, VD occurs suddenly, compared to a slow progression of AD. VD proceeds in moves when each move is connected with a small stroke [9].

2. METHODS

For the purpose of this study, a method of literature review of available sources exploring the two main risk factors of dementia among the people of this group was used. This review was done by searching databases such as Web of Sci-

*Address correspondence to this author at the Philosophical Faculty, University of Hradec Kralove, Rokitanského 62, 50003, Hradec Kralove, Czech Republic; Tel: +420605289160; E-mail: kamil.kuca@fnhk.cz

2666-0830/19 $58.00+.00

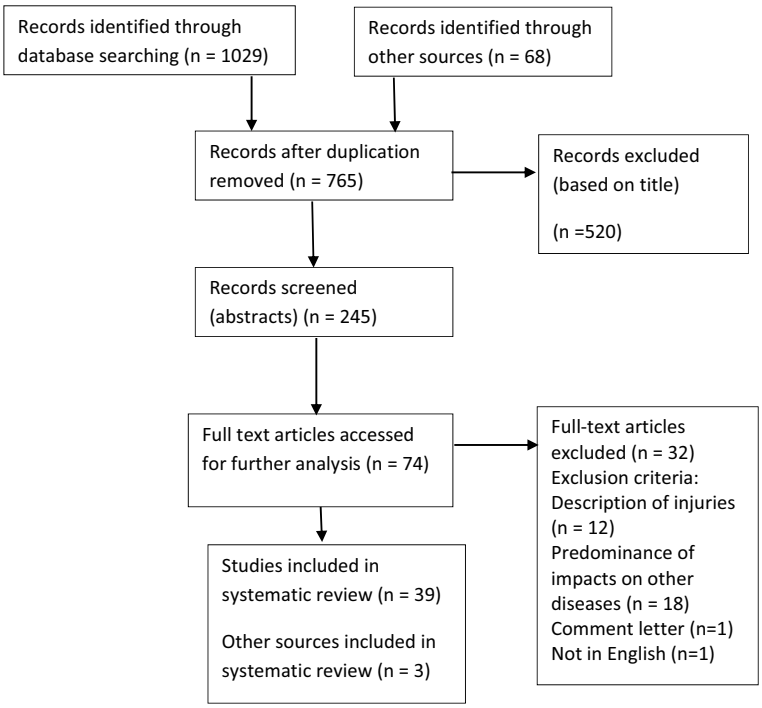

Fig. (1). Results of the systematic review.

ence, ProQuest, Elsevier Science Direct, Springer and Emerald in the period from 2004 to 2015 for the following keywords: combat military personnel and dementia, soldiers and dementia, combat military personnel and traumatic brain injury, combat military personnel and posttraumatic stress disorder, soldiers and traumatic brain injury, soldiers and posttraumatic stress disorder. Based on the evaluation of these literature sources, possibilities of pharmacological and non-pharmacological approaches to the treatment and care of these people were described (Fig. **1**).

2.1. Posttraumatic Stress Disorder and Traumatic Brain Injury Influencing the Risk of Dementias among Combat Military Personnel

There are several causes among younger combat military personnel which can increase the risk of the development of dementia in their later life. It is especially depression which is inevitably comorbid with posttraumatic stress disorder (PTSD) and traumatic brain injury (TBI) and is one of the risk factors of dementia as research studies indicate [3-4]. In fact, it affects 20% of patients suffering from AD and up to 50% of patients with VD [3].

The posttraumatic stress disorder as another risk factor of dementia is an anxiety disorder that can develop after a person is exposed to one or more traumatic events such as major stress, sexual assault, warfare, or other threats to a person's life [10]. The term itself originated in the late 1970s due to diagnoses of US military veterans of the Vietnam War. PTSD can be acute, lasting less than three months, or chronic, persisting more than three months. The common symptoms can be divided into four main groups:

- repetitive, intrusive reminders of the traumatic situation (*e.g.,* nightmares, flashbacks, or uncontrollable shaking);
- extreme avoidance of people and things that can recall the traumatic event;
- impaired cognitive functions, usually connected with negative thinking;
- behavioral disorders (*e.g.,* depression, changes in mood, anxiety, being on guard for danger, or sleeping disorders) [11, 12].

The traumatic brain injury can be defined as an injury that results from external force to the head and causes an alternation of loss of consciousness. TBI can be divided into mild (*i.e*., loss of consciousness lasting less than one hour or amnesia lasting less than 24 hours), moderate (*i.e.,* loss of consciousness lasting between one and 24 hours or posttraumatic amnesia lasting for one to seven days) or severe (*i.e.,* loss of consciousness lasting for more than 24 hours and posttraumatic amnesia lasting for more than a week) [13, 14]. Military TBIs are usually closed head injuries which are caused by exposure to an explosion, motor accident, fall, or physical activity [15]. The most common symptoms can be divided into physical, sensory, behavioral and cognitive. The physical symptoms include loss of consciousness, headaches, tiredness, sleeping problems, and in severe cases, also balance difficulties. The sensory symptoms comprise sensitivity to light or noise, blurred vision, or ringing in the ears. The behavioral symptoms then consist of depression or changes in mood. The cognitive symptoms include loss of memory, attention difficulties, language impairments or delayed reactions [16, 17]. In addition, the repetitive TBI can result in the development of chronic traumatic encephalopathy (CTE) which is mainly associated with behavioral changes, loss of memory and cognitive disorders. Its progress is slow [18].

Many recent research studies [19, 20] also prove the association between TBI and dementia. For example, a

cohort study conducted by Barnes, *et al*. [19] among 188,764 US veterans aged 55+, who did not suffer from any kind of dementia at the beginning of the study, confirmed that in the course of nine years, 16% of soldiers with TBI developed dementia in comparison with those 10% of soldiers who did not have TBI. Thus, the findings indicate that younger soldiers with TBI are at higher risk of developing dementia in their later life. As Stein, *et al*. [20] also state, the pathological cause is in the increased presence of beta-amyloid in the brain of the soldiers with TBI, which most likely starts dementia.

2.2. Treatment of PTSD

Approaches to the treatment of PTSD can be divided into two basic groups: pharmacological treatment and non-pharmacological approaches.

2.2.1. Non-pharmacological Treatment

PTSD can be successfully treated with a number of psychotherapeutic methods which include a group or individual and cognitive-behavioral therapy. Behavioral therapy uses different forms of exposure to traumatic stimuli. There are two types of such exposure: a gradual exposure (from an easier to a more difficult stimulus) or massive (exposure to the most difficult stimulus). Most of these exposures of PTSD are done in imagination. Hofmann and Smits [21] in their study confirm that these exposure therapies have efficacy on the treatment of PTSD symptoms. The strongest evidence of efficacy for improving PTSD symptoms and achieving loss of PTSD diagnosis was for exposure-based therapy. The evidence of moderate strength also supports the efficacy of cognitive therapy (CT), cognitive processing therapy (CPT), cognitive behavioral therapy (CBT), eye movement desensitization and reprocessing (EMDR) and narrative exposure therapy for improving PTSD symptoms and/or achieving loss of PTSD diagnosis [22]. However, many evaluations of the efficacy of psychological treatments have not employed an optimal psychological placebo control treatment: the use of waiting list controls is inadequate to demonstrate potential efficacy [23].

2.2.2. Pharmacological Therapy

The pharmacological treatment focuses on acute symptoms cured with anxiolytics and the consequent long-term treatment cured with antidepressants since psychotherapy is nowadays hardly used. As a rule, it is usually combined with pharmacotherapy which brings faster relief, but on the other side, it is connected with the higher risk of drug side effects. For the treatment of PTSD symptoms, particularly fluoxetine, paroxetine, sertraline, topiramate, and venlafaxine are used thanks to their moderate strength and quite good efficacy. Risperidone may also have some benefit for the reduction of PTSD symptoms [22].

Fluoxetine and paroxetine are inhibitors of some cytochrome P450 enzymes and therefore they might interact with some other psycho-tropic drugs and treatments for physical illness [24]. When stopped abruptly, and even when tapered slowly, SSRIs can produce a discontinuation syndrome characterized by dizziness, insomnia and flu-like symptoms; [25, 26] this seems more likely with paroxetine and least likely with fluoxetine [27]. The SNRIs duloxetine and venlafaxine have proven efficacy in the short-term and long-term treatment of generalised anxiety disorder [28]. A combined treatment approach of antidepressants, cholinesterase inhibitors, vitamins, and diet, and lifestyle and exercise modifications has been found to protract cognitive decline over 24 months and improve memory and frontal lobe functions [23].

2.3. Treatment of TDI

During TBI, person's brain is damaged and its effects are in most cases irreversible. Nevertheless, an early and intense rehabilitation can renew some of the brain functions and can improve TBI symptoms such as physical, behavioral, sensory, or cognitive symptoms. The drugs for the restrictions on secondary damage of the brain immediately after the injury can include diuretics, anti-paroxysmic drugs, and coma-inducing drugs. The diuretics reduce the amount of tissue fluid and increase urine output. They also help people with TBI reduce the brain pressure. The anti-paroxysmic drugs can be administered in the course of the first week in order to prevent further brain damage which could be caused by paroxysm. The coma-inducing drugs are provided if doctors need to put people with TBI in a temporary coma because in unconsciousness, their brain needs less oxygen for its functioning. This is especially useful if the blood vessels compressed by the increased pressure in the brain are able to supply a usual amount of nutrients and oxygen into the brain cells [22].

Moreover, most people who suffer from TBI need some kind of rehabilitation since they often need to learn basic skills such as walking or speaking. Their aim is to improve their abilities to do everyday tasks and a necessity to do different kinds of rehabilitation for some time such as cognitive therapy which is a systematic and functional approach based on the evaluation and understanding of deficits of patient's brain functions. The treatment focuses on the improvement of brain functions and recovery of the patterns used earlier [29]. Another type of rehabilitation is occupational therapy [30] which helps patients to do their daily tasks despite their disabilities. Common ADL (activities of daily living) are divided into smaller and easier tasks and after their completion they are gradually combined together. The occupational therapists also propose a strategy for the management of a given disability and use of compensatory aids. In addition, the so-called EEG Biofeedback method can be used. It is a method of conditioning brainwaves by "reinforcement". The aim of feedback is a return to the basic electrophysiological functioning of the brain at the level before the trauma. At present there are four possible approaches to the treatment of trauma, which are as follows:

- Low Energy Biofeedback system LENS
- Standard quantitative approach to EEG
- Activation of the database QEEG
- "Eye closed" QEEG [29].

The therapeutic approaches can be also interconnected with information technologies. This is what cognitive prosthetics does. It uses findings of the information technologies to the development of software for rehabilitation purposes.

Cognitive disorders are to some extent specific for each individual, therefore it is necessary to tailor every program to the patient's needs according to his/her impairment. The software is installed into the patient's computer and the therapist can provide consultation *via* teleconference [31]. For example, the clinical study [32] focused on the use and efficacy of personal digital assistants (PDA) among patients with cognitive disorders. The study showed that the use of these technologies led to a significant improvement in doing their daily tasks.

Furthermore, it is possible to do the training of walking with the help of the following modern technological devices:

Lokomat - a system formed by motor-driven walking orthoses, moving walkway and suspension system for relieving the weight. The sensors fixed to the orthoses are projected on the monitor in front of the patient. The only disadvantage is the rigid fixation of the pelvis and feet, which results in the change of walking stereotype [33].

AutoAmbulator - a device which is formed by moving walkway, suspension system and three spoke exoskeleton. The patient holds the bar when s/he trains his/her walking [34].

PAM (Pelvic Assist Manipulator) - a device which consists of paired robotic stands and pneumatic pistons. The device leads movements of the pelvis during the training of walking into all directions except anteversion and retroversion. Thanks to this, such walking is close to the physiological walking.

Lokohelp - it consists of the moving walkway, suspension system and independent walking electromotive equipment. It is a cyclic movement on the elliptical orbit, stimulating individual step phases [34].

3. DISCUSSION

As it can be assumed from the information discussed above, both pharmacological treatment and non-pharmacological therapies are essential for PTSD and TBI patients. They both need to be applied in order to make the treatment as efficient as possible. However, both approaches should be used with respect to the specific patient's needs and his complex state of health [7].

Both PTSD and TBI are nowadays called the *signature injuries* of the 21st-century wars, *i.e.,* Iraq and Afghanistan war operations [35]. Although PTSD and TBI are still more common among civilians and in non-deployed military settings, with the increasing number of combat military operations, there will be more and more soldiers at high risk of developing dementia in their later lives. This has been already confirmed by Plassman, *et al*., Yaffe, *et al*., or Weiner, *et al*. [36-38]. Despite PTSD and TBI have different causes, they share certain symptoms such as loss of memory, attention difficulties, communication, or sleeping disorders. Stevelink, *et al*. [39] emphasize mental disorders among the soldiers with a physical impairment. Moreover, people with PTSD and TBI also have behavioral disorders such as depression, changes of mood, anxiety, or emotional distress [17]. Especially depression influences the combat military personnel throughout their whole active service, while dementias develop later in their lives. Therefore researchers [3, 4] also focus on the examination of the association between depression and dementia among the soldiers. The present findings seem to be quite promising.

Apart from PTSD and TBI, there are other lifestyle factors which can be equally significantly influential [40]. These include diabetes, high blood pressure, obesity, a lack of physical activities, depression, smoking, and a low level of education [41]. It is estimated that by 2020 63,000 cases of Alzheimer' disease among the US military veterans will be ascribed to obesity, 75,000 to hypertension, 55,000 to a lack of sufficient physical activities, 49,000 to dislipidemia and 19,000 to diabetes [42].

CONCLUSION

The combat military personnel is a specific group of people whose number due to the global war conflicts will be on its rise in future. This will obviously cause other issues such as increased costs on the treatment and care of these people. As it has been already discussed above, there are just a few drugs on the market which can for some time enable the delay of the development of cognitive decline which is one of the key symptoms of PTSD and TBI. Moreover, attention should also be paid to the behavioral disorders which are prevalent among the soldiers. Therefore alternative approaches such as physical training and other non-invasive therapies, suitable also for behavioral disorders, should be employed in the treatment, care and support of this group of people.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

This research was supported by the project SPEV 2019 (University of Hradec Kralove, Faculty of Informatics and management), Long term development plan UHK. This work was also supported by the projects: LTC INTER COST project no. LTC18035 and COST Action project CA16226.

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