

Updated Findings on the Efficacy of Combined Subanesthetic Ketamine Infusion and Cervical Sympathetic Blockade as a Symptomatic Treatment of PTSD/TBI in a Special Forces Patient with a 2-year Follow-up

A Case Report

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ABSTRACT

Posttraumatic stress disorder (PTSD)/blast traumatic brain injury (bTBI) in a Special Operations Forces (SOF) cohort has been shown to be successfully treated using a cervical sympathetic blockade (CSB)/ketamine infusion (KI) combination, termed the *SOF method*. In a prior case report, the patient was followed for 1 year. This report followed the same patient for a total of 720 days and found prolonged and sustained benefits with respect to PTSD and bTBI symptoms with further application of the SOF method.

KEYWORDS: *SOF; PTSD; ketamine infusion; cervical sympathetic blockade; bTBI; TBI*

Introduction

Special Operations Forces (SOF) represent the most elite members in the U.S. Military. SOF personnel are known to develop higher incidences of blast traumatic brain injury (bTBI) and posttraumatic stress disorder (PTSD), likely due to training and/or the intensity of combat. They develop comorbid neuropsychological disorders, including anxiety, depression, cognitive impairment, and suicidality.¹⁻⁵ Current treatments demonstrate limited efficacy in addressing the unique neuropsychiatric symptoms in SOF members and veterans.⁶ Firstline PTSD treatments have focused on psychotherapy or medication, with drop-out rates of 30%–40% in randomized clinical trials (RCTs). In those who have completed treatment, 60%–80% have recovered, with intention-to-treat analyses⁷ reporting recovery rates as low as a 40%.

bTBI and PTSD present with many overlapping neuropsychiatric symptoms, including anxiety, irritability, insomnia, personality changes, and memory problems, which complicates diagnostic differentiation. The patient received 5 KI and SGB to the left and right sides over a 5-day period (Table 1). Accordingly, SOF personnel would benefit from simultaneous treatment for PTSD and TBI. Ketamine infusion (KI) combined with cervical sympathetic block (CSB), the SOF method,

seems to have a synergistic effect on the symptoms of bTBI and PTSD in the SOF cohort.

Methods

Cervical Sympathetic Block

Detailed informed consent was obtained prior to all procedures for CSB. The patient first received a right-sided CSB with the following protocol. The patient was placed in the supine position with the head rotated slightly to the left, with monitoring per clinic protocol. The skin of the neck was cleaned with chlorhexidine-isopropyl alcohol preparation and 2g of sterile ultrasound gel was applied. The neck was scanned using a broadband linear transducer (8–13 MHz from the level of the 6th to the 4th cervical vertebrae in transverse view) using Mindray MX7. The skin at the injection site on the lateral neck was anesthetized with 1.5mL of 1% lidocaine. Using an in-plane approach under real-time ultrasound guidance, a 22-gauge echogenic needle was placed just dorsal to the ventral fascia of the longus coli, medial to the longus capitus. After aspiration, negative for CSF or blood, 0.5mL of 0.5% bupivacaine was injected, while monitoring the patient. After observing the patient for 30 seconds, a second 4-mL aliquot was injected. The patient was monitored for an additional 30 seconds. After the patient verbally confirmed absence of any concerning symptoms, an additional 4mL of 0.5% bupivacaine was slowly injected over 1 minute for a total injection volume of 8mL for a single-level block. This was repeated at the 4th cervical level, with a total of 4mL of bupivacaine. Left-sided CSB was performed the following day due to safety considerations following the same injection protocol as above.

Ketamine Infusion

Detailed informed consent was obtained prior to all infusions following a consultation. The initial infusion of racemic ketamine hydrochloride (0.5mg/kg) was administered over 45 minutes. Premedication with ondansetron (4-mg intravenous push) was used for all sessions, and an anesthesiologist was

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TABLE 1 Detailed Summary of Pre-Treatment Measures and Follow Up Measures on Day 720

Day	Patient Data							% reduction	Point reduction	
	0	1	2	3	4	5	394			720
Procedure(s)	KI	KI	Right CSB	Left CSB+KI*	KI	KI				
BDI (depression)	31				3		2	1	96.77	29
BAI (anxiety)	15				1		2	1	93.33	13
PCL-5 (PTSD)	42						11		73.81	31
CHRT (propensity)	21	11		12	4		2	0	100	19
CHRT (impulsivity)	6	3		5	4		0	2	66.67	6
CHRT (suicidality)	8	6		4	0		2	0	100	6
CHRT (total)	35	20	0	21	8	0	4	2	94.29	31
KI dose, mg	52	65		75	90	100				

*Patient had left CSB followed by KI.

KI = ketamine infusion; BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; CHRT = Concise Health Risk Tracking CSB = cervical sympathetic block (C6+C4, ultrasound guided); PCL-5 = PTSD Checklist for DSM-5.

present until discharge. During the infusion, a nurse recorded vital signs (heart rate, blood pressure, respirations, pulse oximetry) and clinical status every 5 minutes. Any concerning or intolerable treatment-emergent side effects (e.g., hemodynamic instability, severe dissociation, worsening depression or anxiety) prompted intervention or discontinuation of the infusion. At the end of each infusion, the patient was clinically monitored for at least 1 hour by the nursing staff. Subsequent infusions used escalating doses of ketamine of 0.1–0.2mg/kg titrated to induce mild to moderate dissociation. A total of 5 KIs were performed.

Outcome Measures

Detailed discussion of assessments performed are noted in the prior case report. PTSD Checklist for DSM-5 (PCL-5), Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), and Concise Health Risk Tracking (CHRT) scores were recorded.⁸

Case Presentation

Our patient was a “40-year-old male who, from 2004 to 2014, completed five combat deployments (37 months total), during which he was exposed to physical and emotional stimuli, such as dead bodies, explosions, constant danger, the killing of humans and animals, amongst others.”⁸ He suffered emotional trauma from the loss of multiple friends to suicide and war and from moral injuries sustained during his deployments. He also experienced childhood sexual and physical abuse. His history was also significant for alcohol use disorder as well as three previous suicide attempts. Previous treatment attempts included psychotherapy. The patient had three psychological ward admissions for depression, PTSD, and TBI, respectively. He also was tried on multiple psychiatric medications without results, including various selective serotonin reuptake inhibitors (SSRIs) and serotonin norepinephrine reuptake inhibitors (SNRIs).

The patient was diagnosed with TBI in June 2021 at the Fort Bragg Clinic in North Carolina, where MRI findings displayed white matter changes. He reported having a hard time concentrating on multiple tasks and keeping his mind present. He also experienced impulsivity and disordered sleep, as his mind was always in another place, replaying memories of the past.

The patient received 5 KIs and stellate ganglion block (SGB) to the left and right sides over a 5-day period. The patient reports being sober since the treatment.

Results

The patient was assessed before and after treatment with BDI, BAI, PCL-5, and CHRT scores. The findings were as follows: pre-treatment scores (N=1): PCL-5=42, BDI=31, BAI=15, CHRT=35; post-treatment (2-year) scores (N=1): PCL-5=9 (78.57% reduction), BDI=1 (96.77% reduction), BAI=1 (93.33% reduction), CHRT=2 (94.29% reduction).

In summary, based on the 2-year follow-up results, there was a sustained and significant reduction of PTSD, anxiety, depression, and suicidality scores following KI and SGB treatments.

Discussion

Ketamine may be effective for treating complications that emerge after blast injury through altered hippocampal cell proliferation.^{9,10} In some instances, KI has shown improvements in short-term PTSD symptoms that have lasted 1–2 weeks.¹¹ SGB is a more refined version of CSB, where an anesthetic block is performed at the C4 and C6 levels.

While the exact mechanism is not fully understood, soldiers from the SOF community are likely to experience mixed PTSD/bTBI symptomatology, as these conditions share neural disruptions, such as asymmetrical white matter tract abnormalities and gray matter changes in the basolateral amygdala, hippocampus, and prefrontal cortex.¹² Ketamine and CSB seem to have a synergistic effect, which was discussed in detail by Lipov and colleagues in their 2023 case report.⁸ From this study, there appears to be synergy of KI and SGB therapy for PTSD symptoms while also limiting neurotoxic adverse effects.

Limitations

Our main limitation is that only one patient was studied for prolonged follow-up; thus generalization to others should be limited. Further, isolating independent effects of KI and CSB from the synergistic KI and CSB effect is difficult and requires a large, multi-arm multicenter study. Yet, considering the acute need for treatment of suicides and other PTSD symptoms in

SOF personnel combined with a possible biologic explanation available, the combined KI and CSB impact on clinical symptoms should be evaluated in the near future.

Conclusion

As demonstrated by this case study, combined KI and CSB appear to have a profound and long-lasting impact (over 2 years) on the symptoms of bTBI and PTSD. Although the mechanisms of the effect are not fully elucidated, this treatment approach provides a very effective new treatment for this unique and complex patient population. Further study is needed to determine the true promise of this combined KI/CSB technique.

Author Contributions

EL conceived the study concept. ZS collected the data. HR assembled the manuscript. All authors read and approved the final manuscript.

Disclosures

The authors have nothing to disclose.

Funding

No funding was received for this work.

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PMID: 39621012; DOI: 10.55460/2QC5-PHPF