OK, Doc . . . What Do I Really Have? Posttraumatic Stress Disorder Versus Traumatic Brain Injury

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ABSTRACT

The authors review the diagnostic overlap that exists between posttraumatic stress disorder (PTSD) and traumatic brain injury (TBI). Achieving the correct diagnosis is much more difficult and the potential to inappropriately treat patients is greater than most physicians realize. The need to properly diagnose and select appropriate treatment strategies is essential, especially with TBI cases. A number of new and experimental therapies are being used to treat PTSD effectively and reverse the neurological sequelae of TBI, potentially returning to active duty Servicemembers who are undergoing a medical review board.

KEYWORDS: *posttraumatic stress disorder; traumatic brain injury*

Different Wars, Same Hell

Sources: The 2000 Yard Stare, by Thomas Lea (left), 1944, World War II. From http://imgur.com/ZYYujMI (right).

Introduction

PTSD[1,2] and TBI[3–5] have been part of medicine and war since recorded history. The major difference between preindustrial military campaigns and those that have occurred within the last 150 years has been one of scale and the increase in the survival of wounded Servicemembers.[6–8] Injuries that would have rendered Servicemembers unfit for duty only 100 years ago are now managed and can enable the injured Servicemember to return to full or restricted active duty. Yet, the injuries of the brain and of the mind are notoriously difficult to detect and to treat. The dividing line between a diagnosis of PTSD and a concussion or TBI is hair thin and dependent on the training and temperament of the diagnosing physician. Diagnosis determines the prescribed treatment regimen and if it is wrong, that regimen can do more harm to the individual.

Diagnostic and Statistical Manual, 4th and 5th Editions (DSM-IV, DSM-V)

The effects of PTSD, TBI, and other mental conditions and injuries suffered by returning Servicemembers have a major impact on the lives of the affected individuals, their comrades-in-arms, their families, and their communities. Readiness and the ability to function at the levels required to complete a mission or carry on with one's duty can be compromised by these invisible wounds. Both PTSD and TBI are complex to manage; they are wrapped in cultural biases that make it very difficult to overcome feelings of shame or unworthiness when given a diagnosis of either. A major impediment on the treatment and management of PTSD or TBI is the lack of objective clinical tests that can help with diagnosis. On top of that, the issues of symptoms (of both PTSD and TBI) hamper the ability of sufferers to operate at the level to which they were accustomed prior to their injury. Given the complexity of healthcare delivery, managing the ins and outs of treatment and insurance can be stress inducing.[9] But in today's modern healthcare system, if you don't have a diagnosis, you cannot access treatment easily (or, sometimes, have it covered by insurance).

The DSM-IV[10] and the more recently updated DSM-V[11] are the bibles for diagnosing psychiatric disorders and mental illnesses. If an illness is not in the book, there is no diagnosis to be recognized (or treated). It lists all the clinically identified mental disorders and the possible symptoms, durations, severities, and treatments associated with those disorders.

Unfortunately, gaps exist in the diagnostic criteria. TBIs, especially those that lead to chronic conditions, are difficult to diagnose and can be mistaken for other conditions,[12] but the DSM-V now comes with a warning to clinicians and mental health professionals: "Posttraumatic stress disorder (PTSD) can occur with the NCD [neurocognitive disorder due to TBI] and have overlapping symptoms (e.g., difficulty concentrating, depressed mood, aggressive behavioral disinhibition)."[11] Slowly, the medical community has improved its identification and analysis of the symptoms, applying correct diagnostic tests and prescribing treatments. As we have learned, some treatments are standard and accepted, while others are not, but should be.

Posttraumatic Stress Disorder

Shell shock, battle fatigue, combat exhaustion, nostalgia—these are just a few of the names that have been used to describe the mental state of fighting men and women over the ages (Figure 1).[12] Although PTSD is associated with individuals exposed to the trauma of war, it occurs in the civilian population after a single horrific event (e.g., surviving the 9/11 attacks on the World Trade Center or the Pentagon) or after sustained events (e.g., Hurricane Katrina), as well.[12] The concept of psychological or "invisible wounds" associated with the experience of war or trauma (including accidents, domestic violence, sexual assaults, and so forth) has been part of recorded human experience since 490 BC and earlier. Over the years, the medical and psychological fields have circled around a core set of symptoms and criteria to diagnose this condition. The majority of patients with PTSD routinely work through their symptoms in about 1–3 months without the need for psychoactive drugs, although counseling is a great help; but a proportion of patients develop longer-term symptoms. The current debate within psychological circles is on the role of brain injuries and how they affect PTSD or, if they are TBIs, cause a type of PTSD.[13–15]

Figure 1 *A grief stricken American infantryman whose buddy has been killed in action (Korea, circa 1950).*

Photo courtesy of Sfc. Al Chang, U.S. Army

Diagnostic criteria for PTSD, as defined by DSM-V,[11] include a history of exposure to a traumatic event meeting two of the five criteria (A–E) listed below and symptoms from each of three symptom clusters: intrusive recollections, avoidant/numbing symptoms, and hyperarousal symptoms. A fifth criterion (F) concerns duration of symptoms and a sixth (H) cautions the diagnosing clinician to make sure that drugs (prescription or otherwise) or other disease process are not involved. DSM-IV has fewer criteria, but DSM-IV was used to diagnose PTSD in Servicemembers active during the War on Terror (which started in 2002) and has been used to diagnose the majority of Servicemembers now suffering with PTSD and/or TBI. A Servicemember who was diagnosed with DSM-IV will definitely need to be re-evaluated. The list of eight criteria in the DSM-V is as follows:

A. Stressor: The person has been exposed to a traumatic event that could have resulted in death to others or wounds/injury to themselves or others, coupled with intense emotions (e.g., fear, helplessness, or horror).
B. Intrusive recollection: The traumatic event is persistently reexperienced (must include at least one reexperiencing condition).
   1. Recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions
   2. Recurrent distressing dreams (i.e., nightmares) of the event
   3. Acting or feeling as if the traumatic event were recurring in the present (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur upon awakening or when intoxicated)
   4. Intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event
   5. Physiologic reactivity upon exposure to internal or external cues that symbolize or resemble the incident
C. Avoidant/numbing: Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (must not be present before the trauma; at least three symptoms must be present)
D. Efforts to avoid thoughts, feelings, or conversations associated with the trauma
   1. Efforts to avoid activities, places, or people that arouse recollections of the trauma
   2. Negative changes in thinking and mood associated with the traumatic event
   3. Inability to recall an important aspect of the trauma
   4. Markedly diminished interest or participation in significant activities
   5. Feeling of detachment or estrangement from others

6. Restricted range of affect (e.g., unable to have loving feelings)
7. Sense of foreshortened future (e.g., does not expect to have a career, marriage, children, or a normal life span)

E. Hyperarousal: Persistent symptoms of increasing arousal (must not be present before the trauma; at least two symptoms must be present)
   1. Difficulty falling or staying asleep
   2. Irritability or outbursts of anger
   3. Difficulty concentrating
   4. Hypervigilance
   5. Exaggerated startle response

F. Duration: Duration of the disturbance (symptoms in B, C, and D) is more than 1 month.

G. Functional significance: The disturbance causes clinically significant distress or impairment in social, occupational or interpersonal activities.

H. The disturbance (i.e., the PTSD symptoms) are not attributed to the effects of drugs (prescription or otherwise) or other medical conditions.

These criteria cover a lot of ground and require that a clinical practitioner rule out other causes before providing a diagnosis of PTSD. Many of the symptoms of PTSD are shared with certain strokes,[16] pituitary dysfunction,[17] thyroid deficiencies,[18–20], and major depressive disorders.[21] At the time of the DSM-IV, the psychiatric community was split (and some schools continue to be split) as to whether PTSD is purely an emotional/memory construct (a means to repress an unpleasant memory), a structural brain damage that produces the symptoms of PTSD, or whether PTSD and TBI can occur simultaneously,[14,22] The recent consensus decisions that PTSD and TBI can occur simultaneously was just recognized by the American Psychiatric Association in the DSM-V. Diagnosis is further obscured by the fact that the symptoms are purely subjective: there are no objective measures or verifications required for the diagnosis (e.g., no blood biomarkers or easily obtained brain scans). Therefore, an individual could merely state certain things and walk away with a diagnosis of PTSD. It takes the careful analysis of a complete medical and experiential history, diagnostic laboratory tests (to rule out other causes), and interviews to reach the diagnosis of PTSD. A PTSD diagnosis (or any diagnosis) requires a deliberate and detailed review to rule out what it is not, as much as what it is. Given the high rate of prescription medication used by active duty personnel, PTSD symptoms might appear due to the medication, confounding attempts to diagnose properly.

Traumatic Brain Injury

The DSM-IV had a limited classification system for concussion, including postconcussional disorder (or postconcussion syndrome [PCS]) in a section of diagnoses requiring further study. No specific definition of mild, moderate, or severe TBI is included, although individuals who have suffered significant cognitive, memory, and other higher cognitive deficits as a consequence of a brain injury would be diagnosed as dementia due to TBI. Less severely impacted TBIs would be classified as cognitive disorders.

The definition of a TBI in the DSM-IV is not as up to date as the current standards used by the World Health Organization or the diagnostic criteria of the National Academy of Neuropsychology.[23] The DMS-V has been updated and recognizes major to mild NCD due to TBI. TBIs can be subdivided into mild, moderate, or severe and are dependent on Glasgow Coma Scale ratings. Mild TBI (mTBI) is the most prevalent type of injury (approximately 80% of all head injuries/concussions are in this category) and the most easily missed by physicians and healthcare personnel.[23] In combat medicine and emergency department situations, the prevailing opinion seems to be that if you are not bleeding (too much) or in danger of dying (immediately) and they can't find anything obviously wrong with you, you get shoved out the door or further down the hall. Besides, your platoon, unit, squad, or best friend is heading out on mission . . . and it's only a headache (with nausea or ringing in the ears or some other annoying symptoms); others have had it worse, right? mTBIs are routinely uncovered well after the fact (weeks, months, or years) and sufferers just find a way to cope—until they cannot. Unfortunately, TBIs are cumulative: the more you get, the worse you can potentially become.

A diagnosis of mTBI can be made when there is an injury to the head as a result of blunt trauma, acceleration or deceleration forces, or exposure to blast effects that result in one or more of the following conditions[10,23]:

A. Any period of observed or self-reported:
   1. transient confusion, disorientation, or impaired consciousness
   2. dysfunction of memory immediately before or after the time of injury
   3. loss of consciousness (LOC) lasting less than 30 minutes

B. Observed signs of neurological or neuropsychological dysfunction, such as:
   1. becoming fatigued easily
   2. disordered sleep
   3. headache
   4. vertigo or dizziness
   5. irritability or aggression on little or no provocation
   6. anxiety, depression, or affective liability
   7. changes in personality (e.g., social or sexual inappropriateness)
   8. apathy or lack of spontaneity

Although at least some of the current symptoms listed above are required for a diagnosis of mTBI, the National Institute of Neurological Disease and Stroke has compiled a list of symptoms commonly associated with a TBI (Table 1).[24]

The severity of TBI is normally defined by the acute injury characteristics and not by the severity of symptoms at random points after trauma.[25] Severe TBIs are hard to miss. The mild to moderate TBIs, which make up 80% to 90% of TBI cases, are less obvious, making identification of affected individuals difficult. The problem is twofold. (1) Many times the individual who suffers a TBI does not know what happened. One wakes up without knowing the severity of the injury or the duration of the LOC or even if someone witnessed the injury. There is no reliable way of estimating the energy of impact, which is poorly related to the amount of injury. (2) The so-called severity of injury has little relation the sequelae of PCS.

The use of differential grading scales, as well as the level of medical intervention required to keep the patient alive, dictates the "severity" status of a TBI. More important to TBI diagnosis and treatment is the fact that the effects of a brain injury are cumulative.[26–28] Some people can suffer a single head injury and be fine; if exposed repeatedly to injury (including the pressure waves from bomb blasts or rifle fire), however, they can develop even more severe symptoms and cognitive problems. Current diagnostic practice for a TBI only takes into account the action of a single head injury, not the constant exposure to multiple injuries. Because mTBIs do not show up on radiographs or standard magnetic resonance images, TBIs are routinely missed because the doctors cannot see the affected area (Figure 2). Symptoms of a TBI overlap with other neurological injuries, just like PTSD.

So, Which Is It?

How much overlap is there between TBI and PTSD? The overlap is substantial and difficult to separate out unless a complete history (medical, deployment, and incident history) is available. We will go into some detail to highlight how TBI and PTSD overlap, and Figure 3 summarizes the diagnostic overlap of symptoms and criteria between PTSD and TBI/PCS.

Figure 2 *Servicemember undergoing a computed tomography scan to rule out hemorrhage after a brain injury.*

Table 1 *Symptoms Commonly Associated With a TBI*

Vestibular	Cognitive	Somatosensory	Emotional
Feeling dizzy	Poor concentration, cannot pay attention, easily distracted	Headaches	Difficulty falling or staying asleep
Loss of balance	Forgetfulness, can't remember things	Nausea	Feeling anxious or tense
Poor coordination, clumsy	Difficulty making decisions	Vision problems	Feeling depressed or sad
	Slowed thinking	Sensitivity to light	Irritability, easily annoyed
	Fatigue, loss of energy, tiring easily	Hearing difficulty	Poor frustration tolerance
		Sensitivity to noise	
		Numbness or tingling on part of the body	
		Change in taste and/or smell	
		Loss of appetite or increased appetite	

"The essential feature of post traumatic stress disorder (PTSD) is the development of characteristic symptoms following exposure to one or more traumatic events."[4] The requirement for a traumatic event for PTSD is important, but vague. "Traumatic event" is a ubiquitous definition for a broad set of conditions. A wide variety of traumatic events can cause stress and produce PTSD symptoms: car accidents, exposure to combat, seeing someone hurt, even being confronted with a phobia-linked situation can be called a traumatic event and implicated as a cause of PTSD. Therefore, when applying the term traumatic event to PTSD, having a bomb explode nearby, being hit in the head with debris or getting T-boned at an intersection can count toward PTSD.

Unfortunately, all the conditions just described can also result in a brain injury. Bomb blasts (with no direct head injury), direct head hits, or getting thrown around a car (acceleration-deceleration injuries) produce concussive damage to the brain. Differentiating between PTSD and TBI is very difficult initially. Figure 3 compares PTSD to TBI, side by side, and where they overlap.

Figure 3 *Diagnostic overlap of symptoms and criteria between PTSD and TBI/PCS.*

PTSD			TBI / PCS
Stressor (A)	+	+	Defined Point of Injury
Intrussive Recollection/Distress (B:1)	+	±	Memory of Event
Avoidant/Numbing (C:1)			Symptoms
Avoid thoughts/feeling	+	-	Not Required for TBI Dx
Avoid activites/places	+	±	Not Required for TBI Dx (Common)
Negative Mood/Thought (D:2)			
Blocked memory of stressor	+	+	Amnesia of Injury
Negative Self Belief	+	-	Not Required
Blames Self or Others About Event	+	-	Not Required
Negative Emotional State	+	+	Depression
Diminished Interests	+	+	Apathy or Lack of Spontaneity
Detachment/Estrangement	+	+	Lack of Expression
Inability to Experince Positive Emotions	+	-	Not Required
Hyper-Arousal (E:2)			
Difficullty Falling/Staying Asleep	+	+	Disturbed Sleep Cycle
Irritability/Outburts of Anger	+	+	Irritability/Aggression w/ or w/o provocation
Difficullty Concentrating	+	+	Not required (but common)
Hyper-vigilance	+	+	Anxiety
Exagerated Startle Repsonse	+	±	Not Required (But common)
Reckless/Self Destructive Behavior	+	-	Not Required
Duration (F)	> 1 month	> 3 months	Duration (PCS Dx)
Clinically Significant Impairment of QOL (G)	+	±	Not Required for Dx (but common)
Symptoms are not attributed to			Symptoms are Related to a

DX, diagnosis; QOL, quality of life; PCS, postconcussion syndrome; PTSD, posttraumatic stress disorder; TBI, traumatic brain injury.

Traumatic events overlap, as indicated by DSM-IV criteria (section A), but the next set of criteria for PTSD (DSM-IV, B section) requires that the event be recalled intrusively. With TBI, memory loss is common. Disorientation or scattered recollection of the event can occur with TBI, but intrusive thoughts are not a hallmark of a TBI. Depending on how the physician interprets the symptoms, memories, and findings of a patient, the memory of the trauma may be interpreted as intrusive. The remainder of the criteria required for a diagnosis of PTSD are listed in the PTSD section of this article.

Finally, duration and functional significance are direct overlaps between PTSD and TBI. It takes an involved and observant physician to discern the subtle differences between PTSD and TBI. It also requires that the physician be aware of her/his bias with regard to making diagnoses and to learn to ask the patient a simple question: have you ever experienced one or more injuries to your head or injuries to yourself that altered your perception?

Currently, an ongoing debate within the psychiatric community rests on the assumption that PTSD and TBI are two distinct conditions. The problem comes in separating the physical damage portion from the behavioral (emotional, cognitive process) damage. Case reports suggest that the links between physical damage and PTSD are close, but decades of training and historic reporting instill in doctors the idea that PTSD occurs often without a link to brain injury. It is time to reassess the link between PTSD and TBI.

Summary of Diagnostic Overlap

Any concussive event, even if small and repetitive, such as distant exposure to explosives, repetitive large-caliber fire, improvised explosive devise, sports trauma that results in violent collisions, or falling down, may result in TBI. Evidence is now accumulating that repetitive head trauma, whether it is classified as a concussive event or not, can result in TBI. LOC or being stunned or dazed is not required. Even where stressful events have occurred and are used to construct a diagnosis of PTSD, the possibility of TBI cannot be ignored and an appropriate diagnosis neglected. General memory problems, headaches, sleeplessness, light sensitivity, and balance issues are byproducts of TBI, not PTSD. Head injuries can develop into hormonal disorders,[17,29–32] which can overlap with some PTSD symptoms, but can lead to changes in blood pressure regulation, disturbed sleep cycle, weight gain, and fight-or-flight responses (panic attack). Then again, the use of certain psychoactive compounds can induce similar symptoms and physiological changes that are identical to TBI and PTSD symptoms.

Unless diagnosed properly, psychoactive medications for depression, anxiety, sleep, pain, and panic attacks can worsen these symptoms by further destabilizing the neuronal networks that regulate hormonal balance. Furthermore, many psychoactive medications can lead to

suicidal thoughts, disinhibition, and mood alteration. Combining more than two psychoactive medications (unless monitored very closely by a physician) can lead to unexpected side effects and behaviors.

What Can Be Done

The training a physician receives has a deep and long-lasting effect on how one makes diagnoses. Subtle biases may affect the diagnostic outcome. The diagnosis of PTSD can be made with little hesitation and then the workup stops without having the possibility of TBI or PCS investigated. The experience of one of the authors (J.K.W.) involves several Servicemembers who received blast injuries and were diagnosed with PTSD but received no diagnosis of TBI. Why? Because the diagnosing physician did not ask any further questions or do a full interview to discern the difference. The affected Servicemembers clearly stated how their symptoms were related to the concussive event. In the rush to misdiagnose PTSD, the TBI was overlooked and untreated. Furthermore, the treatments for PTSD (pharmaceutical interventions) made the PCS worse.

At this point, you are probably asking yourself "Ok, ok, ok . . . so now what!? What do I have!? All you are telling me is that I am probably misdiagnosed and/or mistreated [in the medical sense]." All true, but the important difference is that you now know you are potentially misdiagnosed and can seek help or a second opinion from a physician with experience in this area. Treatment plans and therapies exist that can help treat PTSD and TBI effectively. You are not crazy, lazy, or letting anyone down. An injured brain betrays the body in much the same way that a shattered femur stops a person from walking or running: you are not functioning at 100% and cannot function at 100%. PTSD and TBI are mental and physical injuries that can be treated once you know how to identify the problem.

The current treatments that are now available (or quickly becoming available) are slowly being accepted by the medical community. No single therapy will be able to completely undo, reverse, or repair the damage that has been done to the brain or mind. It will require a combined approach to heal the damage.

Our experience as clinicians and medical researchers has shown us treatments like hyperbaric oxygen therapy (HBOT), eye movement desensitization and reprocessing (EMDR), and low-intensity infrared light therapy (LILT) can have measurable improvements in TBI and PTSD (Table 2). Yet, the combining of these therapies has not been applied as standard practice in military medicine or become standard in civilian medicine. Multimodal approaches will likely yield greater benefits than single, sequential applications of therapies. Multimodal approaches will also shorten time to recovery, increase resiliency, and help increase retention rates in the Special Operations field.

A combined and coordinated treatment approach using physical rehabilitation, neurological rehabilitation, psychological and drug and alcohol counseling, vocational training, HBOT, EMDR, infrared therapy, and other noninvasive techniques should provide greater-than-expected results, as will nutritional support during and after therapies. In our opinion, the fear and assumption that neurological injuries are not recoverable and PTSD is a lifelong condition are mostly due to unwillingness by practitioners (and insurers) to apply novel therapies in a concerted manner or break away from conventional thought. TBI and PTSD can be treated and recovery is possible.

Another aspect of recovery from a TBI or PTSD (any injury, really) is the need to incorporate a nutritional plan that promotes mental alertness, supports healing, and helps reduce inflammation in the body. When deployed

Table 2 *Therapies With Evidence for Treating PTSD, TBI, or Both*

Treatment	Used for PTSD	Used for TBI/PCS	Comments
Drugs	Yes	No	Do not help with brain healing. May control some symptoms of PTSD. Usually ineffective for TBI/PCS or make symptoms worse.
Acupuncture	Yes	–	No large controlled studies. Limited case reports show some efficacy.
EMDR	Yes	No	Accepted by the VA and DoD medicine. Helpful for PTSD. Untested for TBI/PCS, but not expected to help.
Low-intensity infrared light therapy	No	Yes	In very early stages. No stage I trials yet
HBOT	Yes	Yes	Impressive track record of improvement in TBI/PCS. Early evidence shows that PTSD may improve where there is concomitant TBI/PCS.
Yoga	Yes	No	No enough evidence to claim efficacy

DoD, Department of Defense; EMDR, eye movement densensitization and reprocessing; HBOT, hyperbaric oxygen therapy; PCS, postconcussion syndrome; PTSD, posttraumatic stress disorder; TBI, traumatic brain injury; VA, Veterans Affairs.

to forward operating bases, nutrition is limited to what can be delivered or gathered, but what food can be delivered on tour or after returning from deployment makes a difference. Mediterranean-style diets (which force a reduction in processed foods that contain a high level of refined sugars and omega-6 fatty acids) emphasizes eating primarily plant-based foods, such as fruits and vegetables, whole grains, legumes, and nuts. Replacing butter with healthy fats, such as olive oil, and using herbs and spices instead of salt to flavor foods is an important modification for a healthy diet. Nutritional supplements of omega-3 fatty acids (docosahexaenoic acid and eicosapentaenoic acid) from clean sources (i.e., mercury-free fish or krill oils) have brain-repairing[33–36] and antiinflammatory properties.[37–39] Reducing or eliminating processed foods is also essential for maintaining brain and body health, as processed foods include omega-6 fatty acids that can promote inflammation.[40]

Limitations

Although TBIs occur too commonly in the Armed Services and can be misdiagnosed as PTSD, there are important considerations and alternative diagnoses to keep in mind. Active duty, training, and deployment have their own unique dangers (aside from the obvious). When discharging rifles, mortars, or other ordinance, there is the risk of metal exposure (lead, copper, mercury) via the lungs or through the skin. Inhaled microscopic metal particles or particles deposited on the skin can be absorbed into the body. Heavy metals build up over time and can result in neurological injury that can mimic TBI, PTSD, or other mental illnesses. The risks of deployed personnel being exposed to environmental hazards and chemicals have been well documented and may have neurological and psychological consequences.[41,42] The potential that infections may be the cause of neurological and behavioral changes must be considered as well. There are a number of pathogens that can alter behavior and wreak havoc with hormone balance and neurological performance.[43,44] HBOT, LILT, or even EMDR may help a patient partially recover from the behavioral and cognitive symptoms, but will result in very short-term recovery if the causative agent is not removed. The diagnosis of PTSD or TBI needs to be assessed with a global and functional approach to treatment and recovery that will be long lasting and ensures the injured Servicemember is correctly diagnosed and prescribed the right treatment.

Disclosure

The authors have nothing to disclose.

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