Science AMA Series: We're the University of Florida's Bauer Lab, let's chat concussions: how they work, who gets them, and why is recovery different for everyone? AUA!

BauerLab [1] and r/Science AMAs[1]

[1]Affiliation not available

April 17, 2023

Abstract

Hi Reddit! UPDATE: Wow, Reddit. We were blown away by the amount and quality of the questions asked today. Thank you for participating, and we apologize that there were so many great questions/comments we couldn't reply to. We tried to put a lot of thought into those that we were able to get to, and we are hopeful that some of our longer answers apply to some of the unanswered questions too. Also, here are a couple of links/resources that you might be helpful. This list is by no means exhaustive, but provides a few additional references on some of the areas that we touched on in our answers: Zurich Consensus Statement on Concussion in Sport: (http://bjsm.bmj.com/content/47/5/250.full/) Bigler, 2008, Neuropsychology and clinical neuroscience of persistent post-concussive syndrome: (https://www.ahead.org/aff/utah/2008.Bigler.PPCS.JINS.pdf/) Mittenberg, 1996 Cognitive-Behavioral Prevention of post-concussion syndrome (http://www.sciencedirect.com/science/article/pii/0887617795000062/) Leddy et al, 2012 Rehabilitation of Concussion and Post-Concussion Syndrome (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3435903/) The Bauer Lab at the University of Florida, students are working to understand the mechanisms and contributing pre-morbid, psychosocial and biological factors leading to different recovery trajectories – i.e. why some people with concussion recover more quickly and with less chronic symptomatology than others with a concussion of similar severity. BauerLab members are also working to understand the role of post-concussion symptoms such as sleep disturbances on longer term functioning, the effect of exercise on recovery and analyzing the manner in which post-injury symptom report impacts recovery timelines in collegiate athletes. We are excited to talk about what we do and answer your concussion related questions! A bit more about our team: Russell Bauer, Ph.D., is Board Certified in Clinical Neuropsychology and is a Professor of Clinical & Health Psychology and Neurology in the College of Public Health and Health Professions. He has authored over 100 peer-reviewed professional papers and is currently involved in the establishment of an interdisciplinary concussion clinic, including Neurology, Physical Therapy, Occupational Therapy and Neuropsychology. Within his lab, students are working to understand factors contributing to differential recovery trajectories – i.e. why some people with concussion recover more quickly and with less chronic symptomatology than others. Aliyah Snyder, M.S., Doctoral Candidate, is currently studying the influence of experience-dependent neuroplasticity on recovery processes after mild traumatic brain injury. Her dissertation project is an interdisciplinary effort examining the safety and tolerability of implementing a brief aerobic exercise intervention during the post-acute period after mild traumatic brain injury. Molly Sullan, M.S., Doctoral Candidate, has primary research interests in determining the relationship between traumatic brain injury (TBI) and sleep disruption in terms of their effect on chronic symptom profiles. She is currently working to identify a methodology with which to study the long term consequences of multiple brain traumas on neurodegenerative processes, as well as the mediating effects of comorbid sleep disturbances on outcome. We will be back at 2 pm ED to answer your questions, ask us anything!

the WINNOWER

REDDIT

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BAUERLAB R/SCIENCE

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Zurich Consensus Statement on Concussion in Sport: (http://bjsm.bmj.com/content/47/5/250.full/)

Bigler, 2008, Neuropsychology and clinical neuroscience of persistent post-concussive syndrome: (https://www.ahead.org/aff/utah/2008.Bigler.PPCS.JINS.pdf/)

Mittenberg, 1996 Cognitive-Behavioral Prevention of post-concussion syndrome (http://www.sciencedirect.com/science/article/pii/0887617795000062/)

Leddy et al, 2012 Rehabilitation of Concussion and Post-Concussion Syndrome (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3435903/)

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READ REVIEWS

WRITE A REVIEW

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How does a concussion happen? I know if you hit your head and what not, but.. I am curious of what happens inside your head when you get a concussion. Are there different stages if severity? How bad can a concussion get ? Can there be long term effects ?

scoobjoe363

Most people believe that a concussion involves acceleration/deceleration of the brain inside the skull, and that causes physiological disruption of brain function. The brain then responds to fight the disruption, and all sorts of changes then take place. For example, blood flow to the brain is typically reduced at the same time that the brain needs more energy to repair itself - this has been called an "energy crisis" It is these underlying changes that take so long to settle down. Some injuries are definitely more severe than others, but we've gotten away of simple grading systems. There can be long-term effects if the concussion is not recognized or managed effectively, if the person gets reinjured before full recovery, or if they have a lot of other problems at the same time.

I have heard from a medical resident that there is anecdotal evidence of inverse correlation between chronic alcohol abuse and traumatic brain injury because brain shrinkage from alcoholism allows the brain to swell more without increasing pressure (within limits). Is there any actual truth behind this or is it a myth? Also, Go Gators!

ZeroTo325

That's a pretty interesting take on the relationship between alcohol and concussion! It can go both ways. Some people have argued that reduced attention due to alcohol ingestion makes the person less likely to anticipate an impact. As a result, they don't brace as much and therefore the actual impact may be mechanically lower. On the other hand, alcohol use can worsen some of the brain's initial physiological response to an injury. We would not recommend the use of alcohol as a preventative measure.

Ok, so I am a high-school wrestler and have had a few concussions. I have a couple of questions:

1)The first concussion I ever had I was dropped on my head about 3 feet from the floor. I was out for two weeks and was back in no time, but my friend had barely hit his head a couple a times and suffered a devastating concussion. He threw up immediately afterwards and was out way longer than I was.

So is it easier to get concussions depending on who you are, or is the risk factor the same?

2) this is personal but I got a concussion for the second time and saw "stars" for ten minutes. The stars were just floaty white lights that were drifting and fading. It has been a while but the other day I got up and the same exact thing happened. I am starting to think I never had a concussion and was very easily misdiagnosed.

So do you think that there should be better ways to diagnose concussions, or is that all on the athlete?

TheLilTPot

This is the $64,000 question. Why two people with exactly the same severity of injury recover so differently is not yet understood. However, we think it may have to do with a variety of factors in the person themselves; we like to say, "it's not just the brain injury, but the brain that is injured". Some people may have genetic predisposition to certain neurologic reactions, and they may be affected

more. Some people are healthier than others, or may have more cognitive resources. Some may cope emotionally better than others. Many researchers are evaluating such factors in terms of predicting concussion. It turns out that pre-existing problems are a good predictor. So, yes, it depends on who you are.
About your second question, we typically rely on the athlete to tell us that something has happened, which is even more important when their behavior seems normal (it's not necessary for them to tell us when they're knocked out). Lots of laboratories are working on ways to diagnose concussions using blood or brain tests, but so far, no test has been successful in clinical diagnosis to the point where clinicians would be comfortable in using it. So, yes, we rely on the athlete, but many athletes don't want to report anything because they want to play. This is where education comes in. We have just recently published a paper showing that athletes who immediately report a concussion return to play faster than those who wait and try to "play through it".

Is there any methods for accelerating/improving the post-concussion "healing"?

yukhateeee

We are particularly interested in this topic. As of right now, clinical trials have been largely unsuccessful in finding way to accelerate or improve recovery, but pre-clinical (animal models) have found some promising behavioral interventions that might enhance your brain's ability to deal with the injury. For example, aerobic exercise is shown to upregulate certain factors (neurotrophins) in the brain that support neuronal, synaptic, and vascular function which aids in injury resolution. BUT there's a big caveat with this one, because if you exercise too soon after the injury, it exacerbates the underlying neuropathological dysfunction. Also, there's a certain time window after the injury where you can maximize the positive impact of your brain's natural capacity for repair. We have a pretty good idea of when those time windows are for rats, but for humans there's a lot more variability. For humans, that safe space is likely within a month of injury, but always consult with an appropriate healthcare provider. In general, following the return-to-play (or activity depending on your goals) set forth by the Zurich consensus statement on sports concussion is the best method currently in place. Briefly, you should increase your activity level in a safe way based on symptom experience. For example, begin doing low impact physical activity (i.e., walking) as tolerated once symptoms have abated. However, this can be complicated when you get to the individual level, because some people do not experience full symptom abatement for days, weeks, or even months after an injury. Thus, activity guidelines should be best managed by their medical team.

For people who go on to experience persistent symptoms, its difficult to feel safe doing physical or cognitive activity that exacerbate symptoms. On the other hand, as we've seen correctly mentioned on some of the replies in this thread, "cocooning" or avoiding activity for long periods of time can be problematic as well, because it can teach the brain that continued symptom experience is the new normal, in a sense. Even in severe neurotrauma, patients are encouraged to begin rehab therapies as soon as possible, once their brain has stabilized, even if they're still experiencing symptoms. The injury itself signals an upregulating or increase in endogenous brain repair as discussed above, and waiting too long, means you miss the opportunity to capitalize on it.

Apart from deeply traumatic concussions, can we see "scars" or physical evidence of concussions after the fact? For example, if you hit your head playing baseball as a child, and developed a mild but undiagnosed concussion, would you be able to find evidence of this during scans as an adult?

Pellantana

Clinically, for mild traumatic brain injury (concussion), we tend to diagnose based on symptom report and brief neurocognitive screeners. Imaging is typically used to determine if there are acute concerns,

such as brain bleeds, which would indicate a more severe injury. However, in the case of mild brain injuries we would not expect to see any structural changes on a clinical MRI (brain scan).

In research settings, we use neuroimaging to analyze microstructural changes in the brain, which may be present long after the injury occurred. For example, susceptibility weighted imaging (SWI) can show changes in microvascular structure from a concussion. Functional magnetic resonance imaging (fMRI) has shown abnormal brain activation patterns after a concussion. Diffusion weighted imaging (DWI), which allows for analysis of the white matter connections between different areas of the brain, has shown changes in white matter integrity in more chronic phases post-injury.

While these are very useful mediums for studying the effects of concussion in the long term, there is still much to be learned in terms of the impact these changes have on clinical symptoms. For example, you can have changes in white matter integrity after a concussion but not show any changes in neurocognitive performance associated with that type of injury (e.g., processing speed). As such, there could conceivably be residual evidence of a concussion as an adult, but it would be difficult to determine whether these changes were related to the concussion you mentioned or to normal biophysiological variation. Likely, for a concussion that resolved without complications, there would likely not be any concerning changes in the brain that could be identified or linked to a remote concussion by traditional clinical imaging.

I sustained my first concussion at the age of 8, and have suffered another 9 since then. I'm currently 27. When I look back at each accident that caused a concussion, it seems like less and less impact force was required for subsequent concussions.

So my question is, does getting a concussion make it easier for you to get future concussions?

SalAtWork

Another great question! There is evidence to suggest your vulnerability for concussions does increase with a past history of concussion. The mechanism for this increased "sensitivity" to experience concussion-like symptoms can be related to a variety of causes. Past literature has discussed possible mediating effects of biological, psychological, environmental and other individual factors that may contribute to this phenomenon. In some cases, when a secondary concussion or impact is received before the previous injury has had time to largely resolve, there can be an additive physiological impact from a secondary impact, contributing to the sensation that you are more "sensitive" to concussion.

There is a hypothesis that there may be subclinical balance dysfunction that may create reduced stability or increase the probability of being in a situation where an injury may occur. Also, genetic factors may contribute to the severity of symptoms post-injury. For example, in their review of the literature on pediatric TBI, Kurowski et al. (2012) compiled results from three studies and found that carriers of the APOE e4 allele had 2.44 greater odds of having poor outcome at 6-12 months post-injury compared to those without this allele. Also, genetic differences in BDNF production (neurotrophin that supports neurogenesis, angiogenesis, and synaptogenesis) are related to increased or decreased ability to recover from neurological insult.

So - the answer to your question is there is evidence that you may be at greater risk for sustaining a subsequent concussion. BUT more work needs to be done to say this definitively. Also - there are likely numerous factors contributing to individual symptom experience. As such, previously injured brains may have a lower threshold for post-concussive symptoms experience than those with no previous signs of injury. Again, more work is needed in this area to say this definitively.

What is the single measure that could be taken in sports to most effectively reduce concussions?

NickC137

Great question! Unfortunately there is no "silver bullet" in identifying and preventing concussions at this time. The best recommendation is education to broadly inform coaches, parents, administrators and athletes to help recognize and manage concussions. Through education, we can minimize the negative effects of concussion by reinforcing the importance of reporting symptoms, giving more information about how to identify concussion and instituting protocols for safely managing symptoms after an injury. The education should extend to preventative measures to improve safe tackling techniques and body awareness on the field, which may help to reduce the frequency and severity of these types of injuries.

Why are some concussions painfully obvious, and others take time to be shown?

Also, is it a myth that you shouldn't sleep with a concussion?

OutlawRacing

As with many of the answers, and agreeably not the most satisfying, it depends :)

As Dr. Bauer often says, the brain that comes to the injury is just as important as the injury itself. Researchers have been trying to answer the age old question of why some people experience concussion symptoms in such a different manner than others with an injury of similar severity level. In many cases, the situation in which a concussion occurs makes a difference for the experience of post-concussion symptomatology. For example, in the middle of a football game, factors such as adrenaline, desire to stay on the field and/or lack of awareness that a concussion has occurred could delay the ability for the symptoms to be associated with a concussion. Further, factors such as previous injury, mechanism of injury (e.g., blast-related injuries in a war zone versus a fall versus a blunt force injury) or area of the brain damaged in the course of the injury all impact the associated clinical symptoms. Also, genetic and biological factors impact symptom severity and presentation. Age plays a role as well - older adults often experience longer recovery timelines than younger adults. Severity of injury is a huge factor - severity of impact and extent of damaged tissue often plays a role in symptoms. Sometimes, the impact of the injury takes time to form. As with anything, physiological processes are activated in the course of an injury, such as inflammation or edema and scarring. In the brain, astroglia migrate to the site of the injury to create a scar around the injured tissue. Sometimes, such processes have no associated clinical symptoms (such as headache, dizziness, confusion, trouble sleeping, etc.) and in other cases the associated symptomatolgy can take time to become apparent.

In terms of your second question - it is not necessarily a myth that you should not sleep following a concussion. The reason for this recommendation was largely due to concern that there was a brain bleed or something more significant occurring that we could not see. If the person with the injury fell asleep, we may not notice symptoms of a stroke or other problem. With the advent of modern imaging techniques and a better understanding of concussion symptomatology, we are better able to rule these problems out earlier in the course of the injury. So, sleeping is not problematic in terms of the concussion itself, but has been associated with more severe problems such as possible brain bleeds following a hit to the head. So, as long as your doctor says you are okay to sleep, it is probably best to go with their recommendations.

I've had 4 concussions in my life. In my grad neuroscience class, one professor came in and said that people with 2+ concussions have an incredibly increased risk for depression down the road. How much science is there to back this up and should I be on the lookout for it? Or was it one of those "one study showed that..." things where it hasn't been replicated or well-documented

thewanderer0

This is actually a fairly strong finding in the research literature. The risk for depression/anxiety does increase after brain injury, especially in the first year. There are several different explanations (including psychosocial adjustment, depressed neuronal functioning, pre-existing vulnerabilities, and/or the interaction of these and more), but the one take away is that no matter what the etiology, people who experience depression or other psychological symptoms after concussion generally respond well to the same interventions that we would recommend with or without an injury (i.e. therapeutic intervention). We do a lot of clinical work as well, and a good portion of that is doing therapy with people who have developed mood disorders in the post-acute period after injury.

I was struck twice in the head receiving a severe concussion and was diagnosed with post concussion syndrome about a month ago. Ever since, I've had trouble sleeping and have taken melatonin every night to get to bed. What exactly is the correlation between sleeping and concussions? Is there anything I can do to help myself sleep better?

RollingTits

Sleep disturbance is one of the most common postconcussion symptoms. We believe that this is because there may be some physiological disruption in brainstem mechanisms controlling the sleep switch. Is the melatonin helping? The most important thing is to try to establish a regular sleep schedule through good sleep hygiene. Try to exercise and limit sleeping/napping during the day. If you continue to have sleep difficulties beyond 3 months post-injury, behavioral sleep treatments such as Cognitive Behavioral Therapy for Insomnia (CBTI) have been shown to be highly effective in reducing post-concussive sleep disturbances. My own bias is that you should try to avoid heavy medications like sedatives or hypnotics during the postconcussion recovery period.

Do you have any propositions or theories about how the NFL could go about improving player safety with relation to concussions without making serious changes to the game of football? I don't know enough about concussions in football and ways to reduce their frequency and severity.

nadawg

We don't have any specific propositions other than (1) reducing the cumulative number of hits by instituting more non-contact practice, (2) teaching and reinforcing tackling and blocking technique, (3) penalizing dangerous behavior (leading with the crown of your helmet, targeting, etc.). Also, the NFL would do well to incentivize health behavior in athletes rather than just incentivizing performance levels. One reason why some athletes don't report concussions is that they know they will be held out of play for some time. If, for example, they have a bonus package in which they receive a monetary bonus for yardage or number of tackles, etc., then they have no incentive to report. However, if they are incentivized to report in some way, behavior may change. This requires a cultural shift.

For Ms. Sullan, what parts of the brain are active when it sleeps? What do these parts do during sleep?

age_of_rationalism

There are many areas of the brain that are active during sleep, making it a very interesting process to study! In general (and this is general, as this is a very complex process), we consider a model termed the "sleep-wake switch." I like this model because it allows for a more simplifies and elegant explanation of what happens during sleep, but, as a warning, it is a simplified model :)

The sleep-wake switch implies that for the wake state to occur, sleep-promoting centers must be "turned off." Thus, during sleep, wake-promoting areas must be inhibited, or turned off and sleep-promoting areas must be active. The main sleep-promoting center in this model is the hypothalamus. Through its white matter connections to wake-promoting nuclei, such as the locus coeruleus, it can inhibit the transmission of messages to the rest of the brain that is should be awake. This process of inhibition from the sleep-promoting areas such as the hypothalamus to the wake-promoting areas, such as the locus coeruleus, happens throughout all stages of sleep. During certain stages, the inhibition is greater, which means activation of another area must be greater. So - to stop one part of the brain from talking, another part of the brain has to exert energy to stop it from talking or reduce the noise it produces. For instance, during rapid eye movement sleep (REM), the locus coeruleus is almost completely inactive.

Alternatively the process of initiating and maintaining slow wave sleep requires the synchronization of many different areas of the brain, suggesting distinct patterns of brain-wide activity. This activity is thought to play a role in memory consolidation and the removal of unnecessary or redundant synapses that appear throughout the day. In this way, your brain naturally reduces the signal-to-noise ratio for newly learned or recently practiced tasks.

More recent literature has shown really exciting new evidence that sleep is necessary for increasing your brains ability to clear metabolic waste which has naturally accumulated during waking. So, the space between your cells opens, or dilates, allowing for the movement of fluids carrying waste products out of your brain. This system is very active during sleep and allows for a natural "cleaning" process to occur. Check out the Nedergaard group for more on this "glymphatic" system (https://www.urmc.rochester.edu/labs/nedergaard-lab/projects/glymphatic_system).

When your brain is injured, these processes (both SWS and glymphatic clearance) can become less efficient or break down. In traumatic brain injury, there is evidence for chances to the amount of time spent in different stages of sleep. For instance, TBI patients were found to spend more time in slow wave sleep than age matched controls, which was thought to be a mechanism for healing following injury. The Nedergaard group has also created interesting animal models of traumatic brain injury, which suggest acute changes to glymphatic system functioning. This system is highly reliant on the sleep stage for adequate clearance as well, making sleep an important target for therapy after any severity level of TBI.

Are there certain areas of the skull that have a greater chance of giving concussions? What are some contributing factors to why these areas are more susceptible if there are any? How big of an impact does the level of force have on the possibility of a concussion occurring?

Twillyso4

This is a really good question. There have been a few studies that have looked at the effects of rapid acceleration/deceleration on pressure waves in the brain. In these studies, the temporal lobes and brainstem appear to be most susceptible. A force impacting brainstem function can result in loss of consciousness. It seems that rotation of the head relative to the body may be important not only in producing damage but also in producing loss of consciousness or immediate symptoms. Also, the base of the brain (anterior parts of the temporal and frontal lobes) are susceptible to injury because they may impact the rough bones of the lower skull during acceleration or deceleration. The question about "how big of an impact" is really interesting - and the answer thus far seems to be that there is no clear "threshold" of force above which an injury will occur and below which you're safe. We are aware of some data from NCAA football using helmet sensors which shows that there are situations in which a concussion occurred at a much lower force than other hits (>100g) in which the athlete got up, high-fived, and returned to the huddle.

I wrote my final year dissertation for my Psychology degree on brain injury, and the public's understanding of it. In this, I discussed the possibility of poor preconceptions and expectations of recovery having a detrimental impact on sufferers. Could this be a legitimate issue, and do you think that increasing public understanding of BI could have a significant positive impact on the suffers and their recoveries?

grermionehanger

There are several studies supporting the notion that low expectations for recovery may have a detrimental impact on both the duration and completeness of recovery. This is why education is so important - there are so many misconceptions out there about the permanency of effects. Wiley Mittenberg at Nova Southeastern University has a simple, brief intervention designed to provide psychoeducation to people with concussions in the immediate aftermath of the injury (i.e. within a few days). This education, which provides the optimistic data that the vast majority of people recover fully, seems to improve outcomes. So yes, we think education is key for everyone involved.

As someone who has had 8 diagnosed concussions I have a few questions:

1. I've noticed that once I have a concussion it is typically followed by frequent mood swings and a lengthy depression phase. Could you explain how concussions lead to these symptoms?

2. Is there a certain number of concussions that could be set as a standard limit for ceasing high risk activity (i.e. Rugby) or does it vary?

3. Finally, what can I be doing now to limit the effects these concussions will have on me later in life (Alzheimer's, dementia, etc.)?

Thank you for your contributions in this field as well as for doing this AMA!

IrishWhiskeyDick

1) Concussion produces mood swings and other symptoms by affecting brain systems involved in the regulation of emotions. We know that the frontal lobes and certain aspects of the limbic system are particularly vulnerable to concussion forces, and it is likely at least transient disruption of physiology in these systems that is responsible for your mood swings. 2) There is no absolute number of concussions that are a standard ticket to retirement. However, many people who have suffered multiple concussions feel that it takes longer to recover from subsequent concussions. Ask yourself whether you can afford to be in recovery mode for increasing periods of time, and whether the joys and rewards of Rugby outweigh the possible health risks and symptoms you're enduring. 3) There are certain risk factors that may make it more or less likely that people develop dementia later in life, independent of concussions. You cannot control your genetics, or your family history, and you can't change the number of concussions you have had. But you can control the number of concussions you will eventually have (see 2, above). You can also modify some risk factors that may improve overall brain health, thus giving you a leg up. Good sleep is critical, and seems to be associated with positive health benefits throughout the body. Maintaining good cardiovascular health will reduce the likelihood of vascular changes that could lead to brain function. Keep yourself mentally and physically active, and try to enhance your cognitive reserve by learning new novel skills. And set a limit on the Irish Whiskey. These are all great questions! Thanks for contributing.

Do you believe that CTE comes from multiple concussions over a long time frame or from repeated head trauma in quicker succession?

I received 3 concussions in a 5 year span as an athlete in high school so I've always been interested in hearing this to gauge my risk for long term effects. I used to get constant headaches but they stopped for the most part about 2 years after my most recent concussion.

From my own cursory research I can't seem to find a straight answer.

Thank you for the AMA! I can't wait to see your thoughts.

Bubbazzzz

This is a fabulous question. Unfortunately, the reason why you cannot find a straight answer to your research is that no straight answer is yet available. On the one hand, one would think that repeated head trauma in rapid succession would be "worse" in the sense that the subsequent concussions might occur during a time where the brain hadn't yet healed, thus producing worse effects. On the other, concussions that are spaced out over time would be more likely to occur in successively older brains that might not be able to respond as effectively. There are no prospective studies on this, however.
The reality is that we do not know precisely what processes link concussion/TBI to neurodegeneration. We think chronic proinflammatory processes may be involved, but the cause is almost certainly multifactorial. It may be that those with repetitive head injuries who become demented later in life also have additional risk factors for dementia. Until we know that, it isn't possible to answer your question with a degree of certainty. The fact that you are asymptomatic now is likely a positive sign. Incidentally, the few studies that have looked at the general relationship between having a history of TBI and developing dementia have not shown strong associations. Also, keep in mind that the majority of cases of CTE that have come to autopsy most likely had substantially more concussion events than you have.

I've been told (by my hockey coaches) if you get a knock or impact which results in sudden head movement/impact and you see stars that you've suffered a concussion. To what degree is this true?

allahucrunchybar

This is probably generally true. One component of a concussion is a "transient change in neurologic function". Seeing stars is not a normal experience, so it may represent just that - a transient change in neurologic function. If you are asking this question in hopes that we will say that "seeing stars" is ok, you may be hedging your bets.

Can you comment on the Chris Benoit situation and how much of a role concussions may have played in the incident?

BahhhhGawwwwd

Our understanding is that Mr. Benoit's brain was examined by the Boston CTE group and was shown to have changes similar to that seen in other studies of football players (CTE). As far as we know, the brain was not independently analyzed. It is tempting to conclude that this explains Mr. Benoit's crime, but such conclusions must wait for more definitive studies to be done. In particular, we need to follow individuals who, by virtue of sports or occupation, are at high risk for repetitive head injury, and to do actual behavioral, psychiatric, and cognitive evaluations of them WHILE THEY ARE ALIVE and to then correlate these findings with brain pathology to be really sure of the links among concussions, aggressive/violent behavior, and brain pathology. To our knowledge, the jury is still out on this.

I'm a military veteran and an advocate for America's military veterans. I'd appreciate any thoughts you might have regarding Traumatic Brain Injury (TBI) in veterans in recent years...mostly due to more sophisticated IEDs than any war previously. It's beginning to appear that even a decade after the (often undetected) injury the symptoms of PTSD and other mental health issues are steadily surfacing.

What else can and should we be doing for our young veterans?

Is VA doing enough? Thanks!

JimmyJoker

Our lab works with Veterans in our VA Brain Rehabilitation Research Center in Gainesville, and agree with your overall assessment of the situation. There is some evidence that at least some of PTSD and other mental health symptoms after TBI are related to the nature of the underlying injury - i.e., that these may at least in part be neurological in origin. Many of the same brain systems involved in TBI are also implicated in PTSD, and the symptoms of TBI overlap substantially with PTSD (sleep disturbance, concentration difficulty, emotional reactivity, etc.). The VA is sponsoring research designed to better understand the causes of these problems so that better treatments can be developed, and the VA provides extensive evaluation and treatment services for veterans with these issues. One thing that could be done in the future is focusing on prevention of PTSD through pre-treatment prior to deployment, a possibility that is being evaluated currently. Another possibility is to provide at least brief PTSD evaluation and services to every returning soldier who has been exposed to blast or blunt injury. There is still a lot of stigma regarding PTSD and mental health concerns in military and veteran populations. Furthering education and understanding that these problems are facets of TBI might make reporting and addressing them more acceptable. Thank you for your service.

Hi, thanks for doing this A! As a soldier that has been concussed by explosions a few times, I am wondering what new information is available about Chronic Traumatic Encephalopathy from blasts. Last I read, it appears through mice models that blast pressures cause tau protein buildup like a Diffuse Axonal Injury to a far greater degree than experienced in sports concussions.

So to clarify the question: Are we close to being able to diagnose CTE before death in humans?

Can anything be done to reverse the effects?

As a guy that has always enjoyed a highly functional brain, you can likely imagine how distressing it is to feel like I am losing my sharpness. Thanks for your time.

TorpedoVegas

Most researchers feel that we are likely 10 years or more away from being able to diagnose CTE before death. Keep in mind that we are not yet definitely able to diagnose Alzhiemer's disease before death, and research on that spectrum of disorders has a much more extensive history. CTE most likely results from the abnormal accumulation of tau in certain specific regions of the brain. Treatments would depend on development of compounds that would be able to clear these deposits from the brain and also reverse associated functional pathology in neurons. I am not aware of such treatments that hold promise for clinical use. What you can do is to do all you can to remain healthy and active, stimulate your brain with novel activities, and sleep well. These are the generally 'modifiable' things that at least give you a leg up on brain health.

Hi Bauer Lab! I am curious- to what extent do you consider psychological factors as having an impact on the symptoms and healing process of a concussion? I've had a concussion before and saw myself attributing certain behaviors or thoughts to the concussion. Even after being more fully healed, I would

sometimes wonder if a migraine I had had anything to do with the recent injury. Thanks so much for doing the AMA!

orionONfire

We think that psychological factors, including your expectations for recovery, and your tendency to attribute any problem you have to the concussion, are very important factors that affect recovery. There are some studies that show that pre-existing psychological difficulties (e.g., depression or anxiety) are strong predictors of protracted (longer) recovery. There is some great research by Wiley Mittenberg at Nova Southeastern University that shows that many people with concussions tend to attribute many everyday problems (e.g., forgetting something, losing track of concentration, which happen to everyone) to their concussions. This, in some people, may set in motion a vicious cycle of expecting problems. If you can avoid this type of thinking, you will generally do better in your recovery.

"Russell Bauer, Ph.D., is Board Certified in Clinical Neuropsychology and is a Professor of Clinical & Health Psychology and Neurology in the College of Public Health and Health Professions." Or, as trump voters believe, he thinks he's better than everybody else and really doesn't know what he's talking about because all he ever did was write fancy papers that nobody even understands.

oddjobdrummer

Is that you, wifey? You're supposed to be at Target.

I played football in high school but stopped at university. Is there any way too make football a safe sport? Or will it always be a sport with brain trauma.

ReverseTheKirs

We think brain trauma will always occur in football, just like it will always occur (though less frequently) with wild partying. Equipment, good technique, reduction in contact practice, and penalties for unsafe behavior (leading with the crown of the helmet, targeting, etc.) are pieces of the puzzle to make it safer. But it is not likely to be made concussion proof, ever.

In which sports are concussions the most common?

SO_RAPID

We agree with ZeroTo325. The interesting question is why would women's ice hockey, in which checking is not allowed, produce the most concussions? One possible reason is not that there are ACTUALLY more concussions there, but that women may be more likely to REPORT concussions than men.

My son plays hockey. At his level of play, mouth guards were made mandatory, with the stated reason being that mouthguards help prevent concussions. This year, the governing body of hockey in our region has removed the mandatory mouthguard policy, stating that their research has shown that mouthguards do very little with regards to concussion prevention.

So, my question is....do mouthguards help prevent concussions or not?

BastionCrazy342

The theory behind mouthguards is that they alter jaw position to dissipate or change mechanical forces, sparing the brain. To our knowledge there is no good scientific evidence to support this in uncontrolled (real life) situations. So I would generally take the same position as your governing board. Mouthguards are really good for teeth, though :).

I was barred from playing football at 19 after my 8th recorded concussion. 3/4 grandparents (so far) have had dementia / Alzheimers without ever playing any contact sports.

I know I'm at a huge risk already for dementia / Alzheimers, what steps can I take now at 23 to help myself for the long run?

I_Dumped_Adele

If you see my answer to IrishWhiskeyDick below, there are some tips for maintaining health in the face of the risk you have. Good luck.

Can you expand upon the usefulness of 1) vestibular therapy for certain recoveries and 2) What roles vitamins and a healthy diet can play in a recovery from a concussion? Thanks so much!

pucksdd

We work with a physical therapist who is trained in vestibulo-ocular therapy and he has had outstanding impact on recovery of dizziness, balance, an related symptoms (including resulting problems with concentration and anxiety) in patients who are having difficulty recovering from concussions. So we have become fans of this type of therapy - it is not needed for everyone, but in those who are complaining of dizziness, balance disturbances, problems focusing for reading, etc., it is quite effective. Not every PT will have such training. Healthy dietary habits play an important role in concussion recovery just as they would in recovery from other injuries or illnesses. There is little systematic data on the effects of specific nutritional supplements on concussion recovery. If the makers of a particular compound purport to help concussion recovery, look to see whether there is fine print, like, "these claims have not been evaluated by the FDA", and that will tell you how good the supportive science is. We are not aware of any large scale clinical trial showing strong positive outcomes for nutritional supplements. However, it stands to reason that a good diet, exercise, and other lifestyle changes (good sleep is critical) that promote health will also promote processes of recovery.

Firstly thanks for doing this AMA! I'll keep this short and simple: What is the neurological/neuromolecular basis for the link between concussions and dementia?

DrZack

In some at risk individuals, repetitive concussions may set in place a cascade of abnormal protein accumulation and proinflammatory processes. Sleep and other physiological disturbance may abet these physiological abnormalities, producing long-term accumulation of misfolded proteins. TBI likely involves abnormalities of both beta amyloid and tau. The effects may be worse in people with other (genetic, environmental) risk factors for dementia, but more work needs to be done to be sure.

There have been some supplements popping up in the marketplace. Is there any credence that these could provide prevention benefits when taken?

coopers98

As far as we know, there is no firm scientific evidence in the form of clinical trials that shows benefit. However, this lack of evidence doesn't mean that they don't help some people. There just isn't any science behind them yet.

Have you connected with the Military regarding the research done on Mild Traumatic Brain Injury from IED's?

Harrytom0910

We are actually doing some of our research at the VA with Veterans of OIF/OEF who have sleep disturbances and memory difficulties from either blast or blunt trauma suffered during deployment.

As both Gators and people who know the dangers of concussions, how do you feel about football?

OvaltineDeathFantasy

We think football is a beautiful game, but that it is a dangerous game. We think that education, research, and good preventative care are key to reducing its dangers. We also believe that much is to be gained by working together (players, doctors, researchers) to make things safer. At UF, we are fortunate to have a culture of collaboration along those lines. Go Gators!