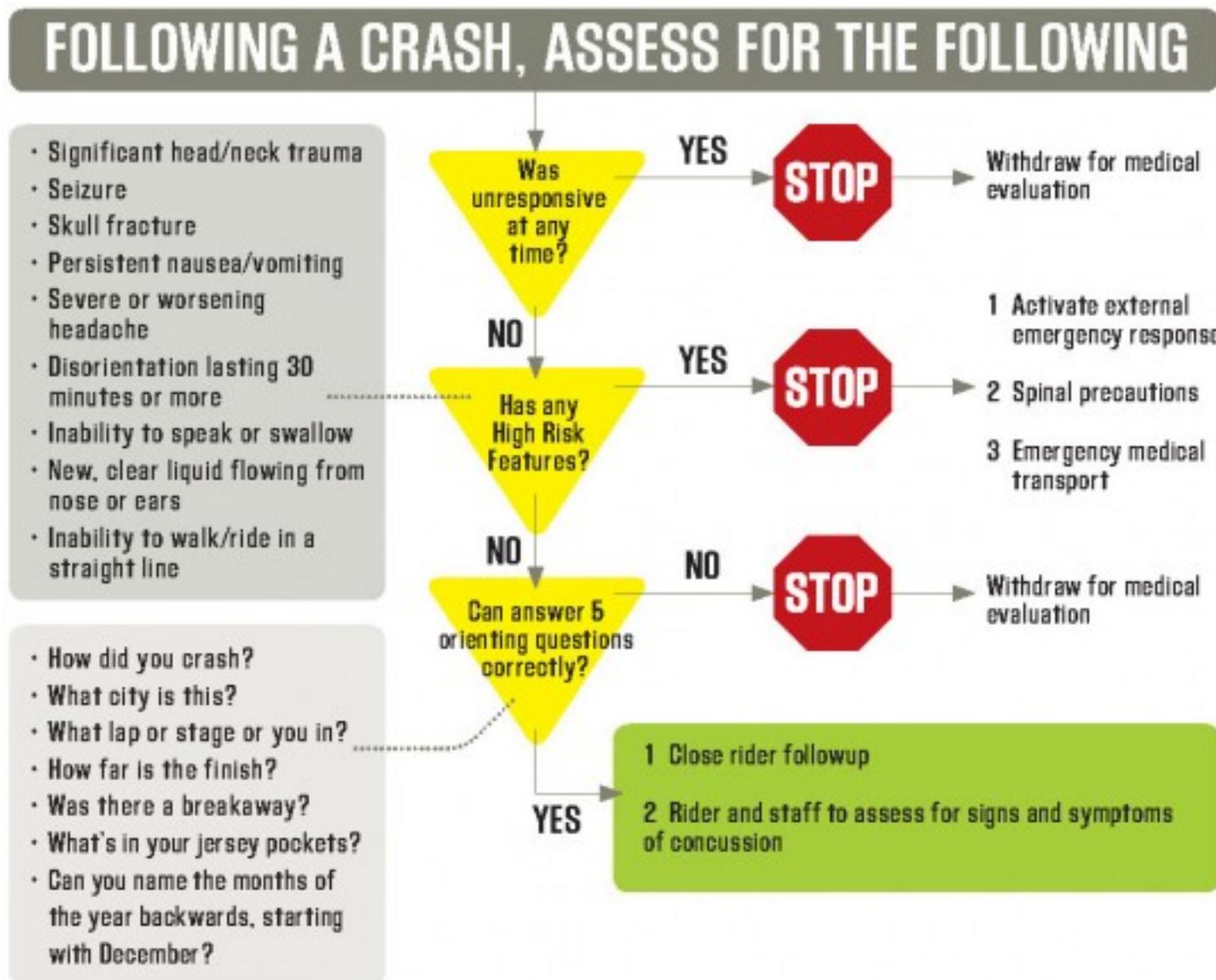


Head first: The variability of injury and recovery from traumatic brain injuries

By Mark Greve, M.D.

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Assessment of brain function following a crash courtesy Medicine of Cycling, www.medicineofcycling.com

Editor's note: This article, on the individual variability and treatment of traumatic brain injuries in sport, originally appeared in the **December 2012** issue of *Velo*, The Danger Issue. The concussion assessment graphic was adapted from a chart created by *Medicine of Cycling*.

The physical abilities of professional cyclists are hard to fathom. Many riders will have nearly a hundred race days in one season, not counting the thousands of training miles they will log. Crashes happen. Usually they're minor, but too often, they can be deadly serious.

It is a tremendous challenge to be able to assess riders properly when they crash in a major event. Medical personnel must jockey through mechanics, motorcycles, and photographers, scanning for who's not moving, who's bloody, and who might need attention the most. It's

imperfect in the best of circumstances. There is no time-out or substitutions and the race is speeding away. All the teams are frantic to get back in the chase.

Generally, so long as a rider is willing and able to get back on his bike, he is permitted to ride. Even riders rendered unconscious, so long as they wake up, will be allowed back on the bike by many physicians. While this is still permitted, it is likely to change very soon — because it's crazy. Lacking leadership from organizing bodies, groups tasked with providing medical coverage, such as Medalist Sports, have permitted their physicians to use standardized treatment algorithms for assessing neurologic injuries in cyclists.

Of all the injuries one could have, traumatic brain injury (TBI) is one of the most serious, more common, and hardest to diagnose. Loss of consciousness is far from the best test for neurologic injury. Of the most severely injured riders, those with major TBI, it's unlikely they will be awake and alert for long. For these riders, the clock has started. Every step in their care carries with it the critical outcomes of life and death, disability and recovery.

Err on the side of caution

From the scene, these riders need to be secured in a cervical collar and a backboard. IV lines need to go in, delivering fluids and pain medications. For riders unable to breathe, they need to be artificially ventilated. And most importantly they need to be rapidly transported to a medical facility capable of treating them.

Once there, a CT scan of the head and cervical spine will be performed. Along with looking for fractures of the head and neck, the CT scan is also used to check for bleeding inside the head; any degree of bleeding is bad. After Timmy Duggan crashed at the 2008 Tour de Georgia and Scott Nydam crashed at the 2009 Tour of the Gila, the bleeding stopped on its own. But with significant bleeding there is an immediate risk. While Saul Raisin was in the hospital after his crash at Circuit de la Sarthe, the bleeding inside his skull worsened, it pushed and distorted his brain, putting him in a coma. A CT scan showed he was herniating, requiring an emergent craniotomy, a hole cut in his skull to pull out the blood clot and relieve the pressure. He would have died otherwise.

Every form of brain injury has some effect on brain function, but they can be hard to predict and measure. There are some broad predictions one can make based on the location and extent of injury. For example, with an injury mostly in the frontal lobe, we'd expect changes in personality, judgment, and expression of speech. But this is based on what we can see in a CT or MRI. We don't know what has gone on, on the cellular level, in any part of the brain. There are new opportunities to map this with technologies such as PET scanning and functional MRI, but the ultimate test is to assess the rider once he or she wakes up.

Still, the brain has a remarkable capacity to heal and rewire. Rehabilitation for the most seriously injured riders can last for years and can be astounding, as we've seen. In the case of Duggan, it seemed his motor skills were unaffected; he was riding a balance board, while juggling, and doing a word game soon after leaving the hospital. But other things, like organization and memory, were affected. When it came to racing, Duggan said, "things that used to be automatic were not there, I had to relearn these processes. I would hesitate and have to relearn 'Oh, this is how I adjust.' The whole first year after the injury was relearning how to race a bike."

With the exact same injury, people will end up with different levels of disability. Some of

these differences can be accounted for by the care they receive. But even with care being the same, the results can differ. We respond to injury differently, we don't have the same way of healing, and we're not wired the same.

Some, like Duggan, were fortunate enough to be able to return to the sport. But it's rare. Nydam struggles to explain how his life is different. "My memory is shot. I lose my keys all the time. I know, everyone loses keys. But I can't remember anything about it. I don't remember where I had them last, what pants I was wearing, what room I was in, I have to start from scratch every time."

In the end, as incredible as the recoveries we've seen from some riders, we need to remember that their lives are irrevocably changed.

Nobody wants to cancel Paris-Roubaix because someone might fall. We cannot be paralyzed by unknowns we cannot control — Jack Seehafer's professional career ended with a high-speed collision with a turtle. We can, however, provide our riders with medical staff properly equipped and empowered to identify and manage traumatic brain injury.

Mark Greve, M.D., is team physician for Team Type 1. He is a clinical assistant professor of emergency medicine at Brown University and a researcher in sports injury at the Rhode Island Injury Prevention Center. He was an early champion for improving the care of neurologically injured cyclists, one of many co-authors for the concussion guidelines for USA Cycling, and developed the first treatment algorithm for assessing neurologically injured riders.

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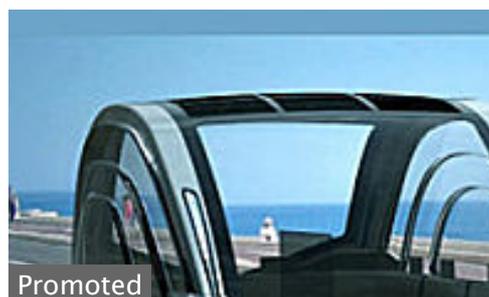
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