Marco F. M. Corrêa, MD
*Centro de Estudos do Mar, Setor de Ciências da
 Terra, Universidade Federal do
 Paraná, Brazil*

Vinícius Abilhoa, MD
*Grupo de Pesquisas em Ictiofauna. Museu de História
 Natural Capão da Imbuia
 Curitiba, PR, Brazil*

References

1. Haddad V Jr, Figueiredo JL. Attack upon a bather by a swordfish: A case report. *Wilderness Environ Med.* 2009; 20:344–346.
2. Oliveira IM, Hazin FHV. Preliminary results on the reproductive biology of the white marlin, *Tetrapturus albidus* poey 1960, in the western equatorial Atlantic Ocean. *Collective Volume of Scientific Papers ICCAT.* 2009;60: 1738–1745.
3. Froese R, Pauly D. FishBase: World Wide Web electronic publication. (Version 01/2010). Available at: <http://www.fishbase.org>. Accessed April 11, 2011.
4. Cervigón FR, Cipriani W, Fischer L, et al. *Fichas FAO de Identificación de Especies Para los Fines de la Pesca. Guía de Campo de las Especies Comerciales Marinas y de Aguas Salobres de la Costa Septentrional de Sur América.* Rome, Italy: FAO; 1992;343:343.
5. Vaske Jr, Vooren CM, Lessa, RP. Feeding habits of four species of Istiophoridae (Pisces: Perciformes) from north-eastern Brazil. *Environ Biol Fish.* 2004;70:293–304.

In Reply to Dr Bornatowski

To the Editor:

In truth, the image used by the authors of the letter shows new aspects of the dorsal fin of the fish, aspects that we could not see in the images that the lifeguard sent us. The fish seems to be the same, but the crucial aspects are not visualized in our images and the identification as *Xiphias gladius* was the most correct prior to the new image. An experienced Brazilian zoologist (ichthyologist) located in the Museum of Zoology, São Paulo University, made the initial identification of the fish. I appreciate the authors' comments, but the main aspect of the description (the attack of a "beak" fish in unusual circumstances) is not changed by this observation. Additionally, I find it strange that the possible new identification of the fish has not been sent directly to us, which would leave us very grateful and indebted to the authors. The direct response to the journal seemed to be most important for some unknown reason.

The text of the letter that questions the conditions of the attacks does not show consistency or experience of the authors with attacks or envenomation by fish. We

obtained *personal* testimonials of the lifeguards who accompanied the first-aid care of the patient, as well as the medical annotations and testimony of the physicians who initially observed the patient—in 2 hospitals that provided care to the patient in both phases of the treatment (in the emergency room and after the surgery). The hospitals are cited in the text. This information resulted in similar statements that formed the basis for our conclusions. There is a serious flaw in the methodology of the text of the letter. The authors used only the testimony of the patient 2 years after the incident. The authors of the letter did not consider that the patient was in shock following the attack, and they, especially, did not consider the stress of the isolated animal in shallow water. We have no doubts about our conclusion, and the authors' conclusion is not supported by the data in their letter. Additionally, they do not suggest other mechanisms of attack, only question what was quoted.

Vidal Haddad Jr, MD, PhD
*Botucatu School of Medicine and Postgraduation
 Program in Zoology
 Biosciences Institute
 Univ Estadual Paulista
 São Paulo State, Brazil*

Suspension Trauma and Rhabdomyolysis

To the Editor:

I read the recent article by Dr Roger Mortimer on suspension trauma and the related case report by Dr Wharton and Dr Mortimer with great interest.^{1,2} The review article by Dr Mortimer is an excellent and thorough summary of the available evidence on this topic. I especially appreciated the fact that he outlined a reasonable approach to medical management of a victim after prolonged suspension. The suggestion that maintaining a rescued victim in an upright posture could be of benefit found its way into occupational safety recommendations some years ago and had become something akin to an "urban legend" in the caving and occupational safety communities. While recent critical reviews of the evidence have led to a clear reversal of these recommendations, the factors contributing to sudden death following prolonged suspension remain poorly understood. In these 2 articles, the authors have made a valuable contribution toward providing a more comprehensive understanding of the dangers of suspension trauma.

I would, however, propose an alternative explanation regarding one aspect of the pathophysiology proposed by the authors in the case report. They stated that rhabdomyolysis was "likely caused by deoxygenated blood in the lower limbs" as a result of prolonged suspension.²

While pooling of blood in the venous system and central hypovolemia clearly occur during passive suspension, significant hypoxia of muscle tissues in the lower extremities would not necessarily ensue unless arterial flow is significantly diminished. It does not seem plausible that this would occur while a victim has a blood pressure sufficient to prevent syncope, as was apparently the case for this individual. Furthermore, the reported serum CPK and myoglobin concentrations are consistent with elevations that often occur following brief episodes of high force exertion.^{3,4} Significant elevations appear most often when individuals engage in atypical exercise, particularly if it involves a significant eccentric component.³ The individual in this case was described as both physically exhausted after a prolonged attempt at self-rescue and hypothermic from hanging in a cold waterfall.⁵ The incident report included a description of his struggles to pull himself upright by gripping his ascender after his climbing system malfunctioned. These repeated attempts at self-rescue could certainly have included a significant number of eccentric contractions of the upper extremities. He was also described as hanging for several hours in a trickling waterfall and shivering uncontrollably.⁵ This would indicate that he suffered from mild to moderate hypothermia during the ordeal. Although hypothermia is a rare cause of rhabdomyolysis in the absence of other risk factors, cold exposure may increase the risk of muscle injury when combined with exercise.⁴

As Dr Mortimer indicates in the review article, there are other documented reports of individuals who had been stranded on a rope and subsequently developed rhabdomyolysis and acute renal failure. However, in these cases the victims also had identifiable risk factors for rhabdomyolysis in addition to prolonged suspension. For example, the caver stranded on a rope in Viking Cave was an inexperienced caver, was using a nonstandard and probably inefficient climbing system, and became exhausted on the rope.⁶ These facts indicate that he engaged in significant exertion to which he was unaccustomed. He was also described as hanging for several hours in a trickling waterfall with inadequate protective clothing.⁶ Reports from rescuers describe the individual as hypothermic with shivering and mental status changes that resolved with rewarming before he was extracted from the cave. This is again consistent with mild-to-moderate hypothermia. In the series of survivors described by Flora and Hözl, all 3 cases of acute renal failure occurred in victims who fell while wearing a chest harness or rope sling.⁷ All 3 victims suffered brachial plexus injuries, suggesting that crush injuries played a significant role. Cold exposure was another common factor. Hypotension and dehydration

are among the most significant risk factors for progression to renal failure after exercise-induced rhabdomyolysis or crush injuries. The hydration status of most of these individuals is not clear from the published reports, but hypotension resulting from sequestration of blood in the lower extremities probably occurred.

The exact sequence of events should not change treatment recommendations regarding rhabdomyolysis following suspension trauma. However, I believe it is quite possible that the initial injury leading to the observed findings was a crush injury in some cases and exertional rhabdomyolysis in others. Progression to renal failure may have occurred due to the presence of other risk factors, most notably prolonged hypotension associated with suspension trauma. This would suggest that rhabdomyolysis should always be suspected but, perhaps, is not inevitable in all cases of prolonged suspension.

Randal Reinertson, MD, PhD
University of Texas Medical Branch
Galveston, TX

References

1. Mortimer RB. Risks and management of prolonged suspension in an alpine harness. *Wilderness Environ Med.* 2011; 22:77–86.
2. Mortimer RB, Wharton DR. Rhabdomyolysis after prolonged suspension in a cave. *Wilderness Environ Med.* 2011;22:52–53.
3. Clarkson PM, Eichner ER. Exertional rhabdomyolysis: does elevated blood creatine kinase foretell renal failure? *Curr Sports Med Rep.* 2006;5:57–60.
4. Lin A C-M, Lin C-M, Wang T-L, Leu J-G. Rhabdomyolysis in 119 students after repetitive exercise. *Br J Sports Med.* 2005;39:e3.
5. Putnam WO. American caving accidents, 2004–2005. *NSS News.* 2007;65 (5, part 1):23–25.
6. Keeler R. American caving accidents, 2006. *NSS News.* 2008;66(3, part 2):16–17.
7. Flora G, Hözl HR. Fatal and non-fatal accidents involving falls into the rope. Paper presented at 2nd International Conference of Mountain Rescue Doctors [German to English translation by HSE Language Services Transl. No. 16372(1)]; November 18, 1972; Innsbruck, Austria.

Reply to Suspension Trauma and Rhabdomyolysis

To the Editor:

We thank Dr Reinertson for his kind words. Urban legend is an apt description of some of the repeated hyperbole surrounding suspension trauma and its treatment.