The evaluation and treatment of water submersion/immersion victims is a controversial topic in emergency medicine. Immersion related deaths continue to be a major cause of accidental death worldwide. And recent studies report that immersion is the third leading cause of death among children. Despite the prevalence of submersion related morbidity and mortality, there is a paucity of evidence based data to guide the management of these patients. As is the case in many environmental emergencies, it is difficult to design prospective studies to evaluate diagnostic and treatment modalities for submersion injuries. The focus of the August 2013 journal club was to review select current literature exploring the diagnosis and treatment of submersion injuries. The topics discussed included: consensus guidelines for the rescue and resuscitation of submersion victims, out of hospital extracorporeal life support, cardiac troponin measurements as a predictor of mortality in submersion victims, freshwater vs. salt water submersion, survival after prolonged submersion, and pediatric morbidity and quality of life after near-drowning.

Because data in regards to submersion and drowning is predominantly based on case reports and cohort studies, there is disagreement in regards to how long search and rescue and resuscitation efforts should be continued. Tipton, et.al. organized a consensus group to discuss this. Their conclusion was that the only factors that have been shown to predict survival are water temperature and duration of submersion and that specifically water below 6 degrees Celsius significantly improved survival. The association between decreased temperatures and survival was reiterated in most of the articles reviewed. Although the mechanism has not been entirely elucidated, many others propose that the rapid cooling that occurs after submersion in cold water is neuro protective. This phenomena has been well documented and studied in the post resuscitation induced hypothermia literature. And induced hypothermia is now common practice in many ED’s and ICU’s.

In addition to water temperature, age has also been associated with increased survival. The case report by Holmaas, et.al. suggests both younger age and post resuscitation lactic acid and potassium levels may also be predictive. In their report, the individual with the lower potassium and lactic acid levels during the post resuscitation phase survived, where as the other individual with higher levels did not. Studies have shown in the past that elevated potassium levels are predictive of mortality in hypothermia patients. And lactic acidosis has been shown in large studies to predict increased rates of mortality in hospitalized ED patients.
Therefore, these findings would make logical sense. However, these studies did not specifically evaluate post-submersion patients. Checchia, et.al. evaluated the utility of cardiac troponins to predict mortality in submersion patients. They concluded that cardiac troponins have a “moderate degree of discriminatory power in selecting children who did not survive to hospital discharge.” Their conclusions were based on receiver operator curve calculations (area under the curve 0.786). However, the average troponin rates between survivors and non-survivors were not statistically significant, and the study was small and included only 9 subjects.

In addition to discussing factors predicting survival, the resuscitation of the submersion victim was also discussed. “Morbidity of Childhood Near-Drowning” by B. Peterson framed the discussion by pointing out earlier observational data on childhood drowning collected in the 1970’s that suggested that patients that required CPR on ED arrival had much higher rates of morbidity and mortality than those individuals that had return of spontaneous circulation prior to ED arrival. He also predicts that as CPR in the field improves and cerebral resuscitation is developed, short and long term outcomes will improve. The discussion in Peterson’s paper is brought full circle by the study by Arlt, et.al., published 36 years later, which describes the use of pre-hospital extracorporeal bypass to resuscitate a 9 year old drowning victim. The authors were able to achieve return of a perfusing cardiac rhythm; however, the child remained brain dead.

Arlt, et.al.’s study calls into question the utility of resuscitation when the potential for recovery is poor. Brain function and quality of life are often a major consideration in post-resuscitation survivors. The final article we discussed by Suominen, et.al. applied two scoring symptoms, health related quality of life and quality-adjusted life years, to successfully resuscitated childhood drowning victims. They concluded that most survivors had a “good” health-related quality of life.

Drowning is a common occurrence and emergency physicians must be familiar with the evaluation and treatment of this emergency regardless of the environment in which they practice. Prospective and controlled studies on this subject are limited. However, the literature reviewed this month provided a frame work for discussion in regards to factors predicting survival, which patients should be resuscitated, and what short and long term outcomes can be suspected after a submersion incident.