Family Practice Forum

The Victim of Submersion

Benjamin H. Josephson, MD, EMT, and Donald H. Wernsing, MD
Summit, New Jersey

There are approximately 7,000 drownings each year in this country.[1] Many more patients are involved in mishaps which are termed "near-drowning." "Near-drowning" is defined as that situation in which a victim, who has been submerged in water for an extended time, survives for at least 24 hours after rescue.[2] As a result of advances in emergency rescue and resuscitation techniques, as well as improved Intensive Care Units, some of the tenets concerning care of victims of submersion are being discarded.

Although the medical literature contains many articles on the topic of drowning and near-drowning, my own experience as a physician and emergency medical technician has been that many primary care physicians as well as paramedical personnel are unaware of the advances in the care of these victims. More importantly, many in these groups are unaware of the lives that can be saved if life-support techniques are begun and continued, even though the traditional time period usually accepted for brain damage and death has been exceeded.

We have long been taught that four to six minutes of apnea is sufficient time to produce brain damage or death, but recent work has shown that this time period is simply too short when applied to submersion, especially if the accident occurs in cold, fresh water. Conn et al[3] reported on 26 cases of near-drowning. Submersion ranged from less than five minutes (eight cases) to greater than ten minutes (six cases). In five cases length of time of submersion was unknown. Mortality occurred in four cases (15 percent) and brain damage occurred in two cases (8 percent). The remaining 20 victims all lived and without sequelae! This is obviously far less than would have been predicted for any series of cases with apnea. In a report by Nemiroff,[4] 11 patients were recovered from cold fresh water (20 C or less), with a submersion time which ranged from 4 minutes to 38 minutes. Eight of these patients survived without neurologic deficit including the one of 38 minutes duration.

Conn et al[3] uses the acronym HYPER for the events which occur to the victim and which must be individually monitored and treated. These are: H—hyperhydration of both lungs and brain;

From the Family Practice Residency Program, Overlook Hospital, Summit, New Jersey. Requests for reprints should be addressed to Dr. Benjamin H. Josephson, Family Practice Residency Program, Overlook Hospital, 193 Morris Avenue, Summit, NJ 07901.

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Y—hyperventilation; P—hyperpyrexia; E—hyperexcitability: and R—hyper-rigidity. Their article gives a concise treatment regimen for each of these complications.

Those who studied near-drownings which occurred in warmer waters (Florida and California) observed more residual brain damage secondary to anoxia than those cases reported from cold water submersion.[5,6] There are two physiologic processes which may account for the greater survival rate and fewer neurological deficits in near-drownings occurring in cold water. Cold water produces two physiologic responses—the diving reflex and hypothermia.[7,8] The diving reflex is a primitive one which occurs when the face is immersed and apnea results. Bradycardia and selective vasoconstriction occur which limit preferential circulation to the heart and brain. These, together with reduced metabolic rate from the hypothermia, are probably the protective events which occur.

In warm water submersion with subsequent cardiac arrest, immediate hypothermia is recommended and may play a similar but less successful role in aiding survival.[9-12] Cardiopulmonary resuscitation (CPR) must begin immediately upon discovery of the victim. If possible, this should be initiated while the victim is still in the water.[13] Although chest compression cannot be started in the water, mouth-to-mouth resuscitation can be started in the water with the victim on a flotation object, such as a long spine board or a reasonable substitute (a door or table top). The long spine board is standard equipment on most first aid ambulances. CPR should be continued until more sophisticated equipment is available or until the victim is hospitalized. "Saves" are attainable long past the golden four to six minutes if life support is started immediately and continued until sophisticated equipment is available to monitor most vital parameters, including intracranial pressure readings.

References

1. Giammona ST: Drowning: Pathophysiology and management. Curr Prob Paediatrics 1(7):1, 1971
2. Schuman SH, Rowe JR, Glazier HM, et al: The iceberg phenomenon of near-drowning. Soc of Crit Care Med 4(2):127, 1976
3. Conn AW, Edmonds JF, Barker GA: Near-drowning in cold fresh water: Current treatment regimen. Can Anaesth Soc J 25:259, 1978
4. Nemiroff MJ: "Drowning" victims recover completely. Med World News 18(13):24, 1977
5. Petersen B: Morbidity of childhood near-drowning. Pediatrics 59:364, 1977
6. Fandel I, Bancalari E: Near-drowning in children: Clinical aspects. Pediatrics 58:573, 1976
7. Hunt PK: Never say drowned. Emerg Med 7(5):136, 1975
8. Gooden B: Drowning and the diving reflex in man. Med J Aust 2:583, 1972
9. Craig AB, Cranes SA, Kwudson RD, et al: Drowning's deadly toll: Can more be saved? Physician and Sports Med 5(8):28, 1977
10. Golden F St C, Rivers JF: Thoughts on immediate care: The immersion incident. Anaesthesia 30:364, 1975
11. Redding JS, Yakaitis RW, Herschel-King C: Problems in the management of drowning victims. Md State Med J 19:58, 1970
12. Ohlsson K, Beckman M: Drowning: Reflections based on two cases. Acta Chir Scand 128:327, 1964
13. Knopp R: Near-drowning. J Am Coll Emerg Physicians 7:249, 1978