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EMERGENCY CARE OF DROWNING

Ad Hoc Panel on the Treatment of Drowning

Committee to Advise the American National Red Cross
Division of Medical Sciences
Assembly of Life Sciences
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This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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Emergency Care of Drowning

The Committee to Advise the American Red Cross of the Division of Medical Sciences, National Research Council, was asked by the American Red Cross to answer the following questions relating to possible use of the Heimlich Maneuver in the removal of water from the lungs of drowning victims

1. Is there a method that the lay person can quickly and effectively use to remove water from the lungs of a drowning victim? Might the Heimlich Maneuver be used?
2. Is the amount of water in the lungs of drowning victims of sufficient quantity to negate successful artificial respiration?
3. Are Dr. Heimlich's claims correct when applied to drownings in salt water, since salt water is not absorbed into the circulatory system?
4. If the answers to the above questions are yes, and if all known techniques to clear the drowning victim's air passage by the rescuer are unsuccessful, do the advantages of using the Heimlich Maneuver outweigh the dangers of possible aspiration of the stomach contents?

These questions were answered by the Committee as follows.

1. There is no method that a lay person should use to remove water from the lungs of a drowning victim. This conclusion was reached for the following reasons:

First, reports of large series of near-drowned patients do not suggest that water in the airway prevents effective ventilation.[1-5] A study of experimental animals showed that no water could be suctioned from their tracheas three minutes after aspirating 11 mg/kg of fresh water.[6] The same study demonstrated that 115% of the volume of fluid aspirated could be suctioned from the tracheas of animals that aspirated 11 mg/kg of seawater. In other animal studies, there have

been no reports of inability to perform ventilation after the aspiration of water. Similarly, in a study performed on humans shortly after death, little water could be drained from the lungs after the instillation of 1-2 liters of 1% saline through a tracheal tube. Ventilation with 1-2 liters of air was not impaired even after the instillation of 2 liters of saline.[7] It is concluded, therefore, that the aspiration of water into the lungs is not the primary obstacle to ventilation.

Second, a danger exists of aspiration of solid material from the stomach which may cause airway obstruction. This may be due to regurgitation or vomiting secondary to underwater struggling and swallowing of large amounts of water, causing gastric distension. It may also be a consequence of the performance of the Heimlich maneuver. When a victim cannot be ventilated by appropriate techniques, airway obstruction must be considered and the techniques for emergency management of the obstructed airway, as outlined by the Committee on Emergency Medical Services,[8] should be carried out in the order recommended.

Thus, it appears to be unnecessary to attempt to drain or otherwise remove water from the lungs prior to ventilation and that attempting to do so may be detrimental because it increases the risk of aspiration of gastric contents and delays the initiation of effective ventilation.

2. The amount of water in the lungs of drowning victims is not of sufficient quantity to negate artificial respiration according to the articles referenced above,[4,11,12] in which it is shown that some water may be aspirated, but that it is rapidly absorbed into the circulation in fresh-water drowning. After fresh-water aspiration, water usually cannot be drained from the lungs,[6] although pulmonary edema fluid may be present (which should not be drained or suctioned). Again, there is no evidence to suggest that airway obstruction due to water occurs or that ventilation was impeded by the presence of fluid.

This question implies that successful artificial respiration can be delivered under the circumstances. In actual situations, artificial respiration may not be performed as efficiently as it is in a training

situation on a mannequin. The difficulty of airway maintenance and coordination of ventilation with chest compressions, the presence of vomitus or pulmonary edema fluid in the mouth of a victim who is frequently a stranger to the rescuer, and the stress of the sudden presentation of the accident must all contribute to decreased effectiveness of emergency ventilation. In addition, the inability at the scene to provide supplemental oxygen and positive end-expiratory pressure (PEEP) or continuous positive airway pressure (CPAP), which are necessary to improve arterial oxygenation after near-drowning,[9] limits the ability to restore tissue oxygenation even when ventilation is easily performed at the scene. Dr. Heimlich suggests that many drowning victims may have lived if the Heimlich maneuver had been performed.[10] The Committee questions this on the basis of the discussion above.

3. In salt-water drownings, no data were found to suggest that ventilation cannot be effective after seawater aspiration.[13,14] The few anecdotal cases which have been reported may have resulted from the situations described above, in which the recommended techniques may not have been performed properly.

4. The conclusion of the Advisory Committee to the American Red Cross is that the current research (cited above) indicates that the major emphasis in the treatment of drowning should continue to be the rapid opening of the airway with the initiation of cardiopulmonary resuscitation (CPR). There certainly may be times when large volumes of water are aspirated into the stomach and, the stomach being engorged, may make effective CPR not optimal. In such a case, emptying of the stomach may be appropriate when performed by trained personnel.

Additional research in the area of drowning and appropriate first aid measures are in order regarding these issues. For now, until data is available, CPR, followed by appropriate advanced life support procedures, should be the initial first step. This should be followed by vigorous efforts at resuscitation including cerebral resuscitation[15] at appropriate hospitals. The Heimlich Maneuver is not recommended for the removal of water from the lungs of a drowning victim.

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