TOPIC: Swimmers' endurance technique can be deadly

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NORTHEAST CITY: 09/25/2006 – During the past several years, an epidemic of drownings has occurred nationwide. It involves trained athletes and swimmers who have engaged in a dangerous practice of underwater swimming while holding their breath as an endurance training technique.

This involves athletes and students who are high achievers and competitors, and all of them have died while holding their breath underwater in an attempt to achieve a competitive edge and improve their endurance.

The medical literature is replete with a collation of drowning cases and near-drownings in individuals who have purposely hyperventilated before attempting lengthy underwater swimming exercises.

What made this alarming was that these individuals were all excellent swimmers, and the tragedies almost always occurred in pools that had lifeguards.

Most swimmers who died from this practice hyperventilated, thinking that doing so would increase their oxygen stores so that they could stay underwater longer.

Hyperventilation actually decreases the body’s natural stores of carbon dioxide while adding very little to its oxygen reserves. The common misconception is that the drive to breathe is triggered by a lack of oxygen. However, the level of carbon dioxide in the blood is a much stronger stimulus that prompts the breathing reflex.

By hyperventilating and blowing off excess carbon dioxide, the swimmer loses that respiratory drive, and because of depleted oxygen reserves, shallow water blackout occurs. A loss of consciousness underwater can trigger a series of events including inhalation of water, cardiac arrest, brain damage, and death.

In 1976, 58 cases of shallow water blackout drownings were reported and commented on in the Journal of Medicine and Sciences in Sports.

In most fatalities, the victims were known to have learned the value of and had previously employed hyperventilation to increase their breath-holding time. The coroners concluded that in almost all instances the death, which occurred underwater, constituted death by drowning without any pathologic evidence to support this conclusion.

It is conceivable that the hypoxia (low oxygen state) led to loss of consciousness, which in turn would cause total relaxation of the muscles, suspending respiration. If the lung volume at that time was greater than the expiratory reserve volume of the lungs under those conditions, air would be expelled passively.

The effect of severe hypoxia would then prevent the effort to inhale, which would be expected after expiration, and in the next few seconds death would occur.

Most autopsies observed that the heart was dilated, the liver became passively congested and acute pulmonary hypertension ensued. Acute hypoxia has this classic effect on the pulmonary circulation.

What can confuse coroners at the time of autopsy is that once the muscles of respiration relax and spontaneous breathing movements fail to ensue, the individual as a terminal event aspires water, which leads then to the erroneous conclusion of death by drowning.

The increase of oxygen consumption must shorten the time course from the beginning of the apnea (cessation of breathing) to unconsciousness with relaxation of the muscles and subsequent inhalation of water then death within 2.5 minutes. This is in contradiction to what we know about drowning in the non-breath-holding situation when it takes about eight minutes from the cessation of respiration until death.

One characteristic aspect of hypoxia is that loss of consciousness occurs with little specific warning. It is much different from a faint caused by hypotension or drop in blood pressure. In the latter instance, the subject usually has several seconds’ warning. But hypoxic subjects can sometimes continue their previous activity in the moment between loss of consciousness and final collapse.

In addition, there remains a subset of young athletes who possess the congenital long-QT syndrome and other cardiac channel defects or abnormalities that may suffer a swimming-triggered cardiac event precipitated by this form of hypoxic training.

It is true that most aquatic staffs, lifeguards, pool managers and coaches understand and are familiar with shallow water blackout and how it results from underwater breath-holding exercises, training techniques and games.

It is alarming and worrisome, however, that some primary organizations that train and certify pool lifeguards provide only vague references to this dangerous training practice in their manuals.

It is imperative that these institutions update their teaching manuals and make paramount in their lifeguard certification procedures that underwater breath-holding training exercises should be strictly forbidden. It is important that swim coaches not employ hypoxic training as part of their training exercises.

The medical profession must become more aware of this dangerous practice to add their considerable weight to seeing that the practice of hypoxic underwater breath-holding is abolished.

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What we know:

● Breath-hold diving (also referred to—accurately or inaccurately—as hypoxic training and shallow water blackout) has evolved from a not-so-harmless children’s game into a pseudo-sport that involves trained athletes who participate in
underwater breath-holding as a challenge or to try and increase their oxygen reserve and thus their competitive edge.

- In reality hyperventilating adds very little oxygen to an individual’s reserve. What it does do is force carbon dioxide out of the lungs – carbon dioxide that signals the brain to breathe.
- This technique is known to cause severe hypoxia which produces muscle relaxation and respiratory system suppression.
- Death can occur within two and one half minutes after breathing has stopped in a drowning that involves breath-holding. In comparison, death usually occurs about eight minutes after breathing has stopped in a drowning that does not involve breath-holding.
- Breath-hold diving is also a popular children’s activity – both static, where the children see who can hold their breath the longest, and dynamic, where they see who can swim the farthest without taking a breath. Both forms place the children at risk and increase the lifeguard’s burden.
- An unconscious, drowning victim will probably not appear significantly different than a motionless, breath-holding person. Permitting such behavior increases the criticality of lifeguard scanning and decreases the level of safety in a pool.
- All the submersion incidents noted by the author involved highly trained athletes and almost all occurred in guarded swimming pools. Any experienced lifeguard can cite instances from his or her own experience of children who have suffered at least unpleasantness from playing such a game – some sadly relate much more serious results. Y of the USA, Ellis Associates, and The Redwoods Group all advise against breath-hold diving, at least as a general rule. The Redwoods Group categorically advises against any application of either dynamic or static breath-holding.
- Aquatic expert Tom Griffiths states that anyone who practices competitive, and repetitive underwater breath-holding is at risk for Shallow Water Blackout

What we don’t know:

- How many programs endorse and/or allow under water breath-holding
- How many individuals (coaches, employees, athletes) are properly educated
- How many pools actively correct children who play such games

What must be remembered:

- The dangerous practice of underwater breath-holding should not be implemented in any type of aquatic swim program. In addition, it should be prohibited in all lap, open, public, or family swim sessions.
- All types of breath holding are dangerous and should be prohibited. This includes static, dynamic, and hypoxic training.
- Hypoxic training and hyperventilation does not have to occur for shallow water blackouts to occur. Kids playing breath holding games and swimmers swimming as far as they can underwater are also dangerous activities and should be prohibited.

- Any vigorous exercise done underwater will limit the amount of time one can stay underwater. Swimmers should be encouraged to head to the surface well before their limits are exceeded.
- The risks of shallow water blackouts should be explained to children and why breath holding games can lead to blackouts.
- It is important to increase awareness on the potential risk factors associated with underwater breath-holding.
- An increase in carbon dioxide levels will signal the brain that it is time to breathe. Hyperventilating depletes the carbon dioxide level which fools the body into believing it doesn’t need oxygen and can lead to a loss of consciousness which can result in death.
- Teaching material should be updated and an educational section should added to increase awareness on why this practice should be prohibited
- It is highly encouraged that all staff members (coaches, lifeguards, members) be properly educated on the possible risk factors associated with this technique.

Please call us at 800-463-8546 to discuss this or any other risk management safety tip, or visit our web site at www.redwoodsgroup.com to learn more about YMCA risk management issues.