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KNOWLEDGE SERIES

THE EFFECTS OF UNDERWATER SPORTS ON THE CARDIOVASCULAR SYSTEM

Understanding how water pressure, breath-holding, exercise and temperature affect the heart and circulation

HEART

CIRCULATION

SAFETY

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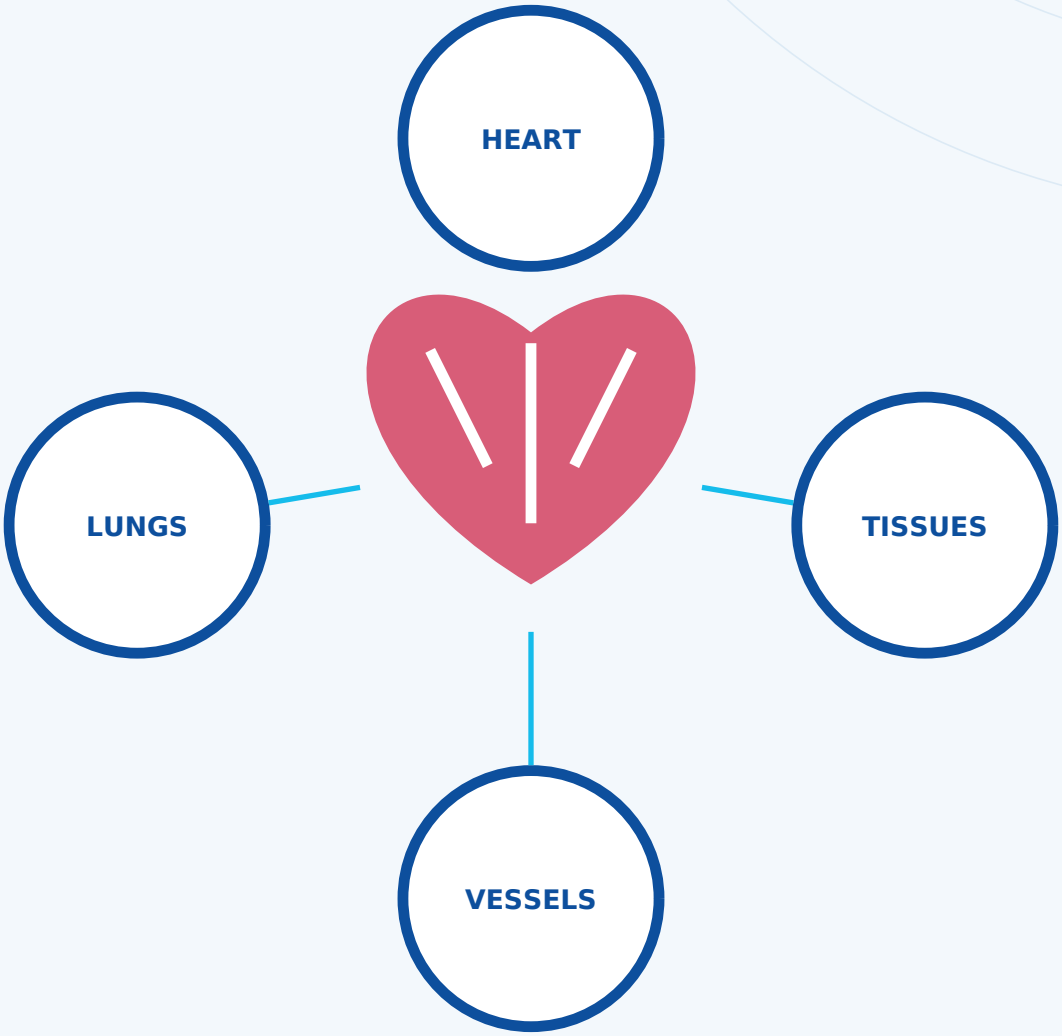
Why was this guide prepared?

Underwater sports combine the benefits of exercise with the distinctive physical conditions of water. As soon as the body is immersed, hydrostatic pressure shifts part of the blood from the legs toward the chest. Breath-holding, facial immersion, physical effort and water temperature can also alter heart rate and vascular responses.

Most of these changes are part of normal physiological adaptation in a healthy, trained athlete. However, simple statements such as “the heart always works less in water” or “a lower heart rate always means safety” are misleading. Rest, swimming, breath-holding and physical contact may produce different responses in the same athlete.

This guide explains how the heart and circulation change underwater, while separating potential benefits, normal strain and symptoms that require medical assessment.

What do the heart and circulation do?



The heart is the body's pump. With each contraction it sends blood to the lungs and tissues, while blood vessels form the distribution network. During exercise, working muscles need more oxygen, so heart rate and cardiac output rise.

The basic system remains the same in water, but blood distribution changes. External water pressure moves venous blood, particularly from the legs, toward the chest. Venous return may rise and the heart may pump more blood with each beat.

For this reason, heart rate alone does not describe the heart's total workload. Stroke volume may be high even when the pulse is somewhat lower.

How does immersion change circulation?

When water reaches chest level, hydrostatic pressure reduces the pooling of blood caused by gravity in the legs. Blood shifts centrally, and cardiac filling and stroke volume may increase.

The body senses this central fluid shift. The kidneys and hormonal systems respond, which helps explain why immersion can increase the need to urinate.

The response varies with immersion depth, water temperature, body position and health status. A resting response cannot be assumed to remain the same during fast swimming or physical struggle.

Why can heart rate fall?

Facial immersion and breath-holding can trigger components of the human diving response. Heart rate may slow and peripheral blood vessels may constrict, helping preserve circulation to vital organs such as the heart and brain.

Underwater Rugby is not a quiet breath-hold. The athlete may be swimming, accelerating, making contact and deciding at the same time. Exercise pushes heart rate upward, while the diving response may act in the opposite direction. The net effect varies between individuals and from one play to another.

A low pulse is therefore not automatically a sign of superior fitness, and a high pulse is not by itself proof of danger. Symptoms and context must be considered together.

Breath-holding and circulation

As breath-holding continues, carbon dioxide rises and oxygen gradually falls. Higher carbon dioxide strengthens the urge to breathe and can influence vascular tone and cerebral blood flow.

During prolonged or forced breath-holding, vascular resistance and blood pressure may increase. When breath-holding is combined with exercise, the cardiovascular load becomes more complex.

Hyperventilation can delay the urge to breathe, but it does not reliably warn the athlete when oxygen reaches a dangerous level. It is not a safe performance strategy, and breath-hold practice should never be performed alone.

Exercise and the water environment

Buoyancy can reduce joint loading, while water resistance makes muscles work harder. In dynamic sports such as swimming and Underwater Rugby, cardiac output rises to supply active muscles.

At the same oxygen consumption, heart rate in water may differ from land exercise. Water temperature, horizontal posture, central blood volume and training status all influence the response.

Regular, appropriately dosed aquatic exercise may support aerobic capacity, vascular function and overall fitness. Benefits come from gradual and individualised training, not from the idea that harder is always better.

How does cold water affect the heart?

Cold water can cause rapid peripheral vasoconstriction. Central blood shift and the stress response may raise blood pressure. Sudden cold exposure can also accelerate breathing and influence cardiac rhythm.

Cold facial immersion may activate the heart-slowing diving response, while whole-body cold stress activates systems that raise heart rate. This autonomic conflict may increase arrhythmia risk in susceptible individuals.

Gradual entry, adequate warm-up and medical assessment for known heart disease are important precautions.

Potential benefits of regular training

Appropriately planned aerobic training can improve cardiac efficiency and the muscles' ability to use oxygen. Resting heart rate may fall over time, and a given workload may feel easier.

Because water supports body weight, aquatic exercise may be more sustainable for some people. Vascular responsiveness, blood-pressure control and cardiorespiratory endurance may improve.

These benefits are not identical for every sport or athlete. Intensity, duration, temperature, breathing pattern, sleep, hydration and medical conditions all influence the outcome.

The specific load of Underwater Rugby

Underwater Rugby combines short bursts of high-intensity exercise, repeated breath-holding, rapid surfacing and physical contact. Cardiovascular load therefore fluctuates rather than remaining steady.

During one play, exercise may raise heart rate while breath-holding and facial immersion act differently. When the athlete surfaces and resumes breathing, circulation rapidly readjusts before the next shift.

Fitness matters, but safe performance also depends on timely surfacing, adequate recovery and taking unfamiliar symptoms seriously.

Hydration and recovery

Athletes may not notice sweating in water. Immersion-related diuresis can add to fluid loss. Dehydration reduces circulating volume and may increase heart rate and perceived effort.

Fluids should be taken before training, during appropriate breaks and afterward. Electrolyte needs during long or intense sessions depend on the athlete and conditions.

Headache, marked fatigue, dark urine, cramps and an unusual rise in heart rate may be related to inadequate hydration, although other causes must also be considered.

Which symptoms require attention?

Chest pain, fainting or near-fainting, unusual palpitations, marked breathlessness, an unexplained sudden drop in performance and exercise-related dizziness require medical assessment.

When symptoms occur in the water, the athlete should not be left alone or pressured to return. Loss of consciousness, severe chest pain or serious breathing difficulty must be treated as emergencies.

Medical evaluation is especially important with known heart disease, a family history of sudden death at a young age, valve or aortic disease, arrhythmia, or fainting during exercise.

Athletes with cardiovascular disease

Not every person with cardiovascular disease must avoid water sports. However, the central blood-volume shift, cold-water response and breath-holding may create special risks in some conditions.

Heart failure, severe valve disease, uncontrolled hypertension, significant arrhythmia, aortic disease and some inherited electrical disorders require particular attention.

Decisions should not be based on the diagnosis name alone. Severity, symptoms, imaging, exercise capacity, medication and the specific sport must be considered together.

A brief safe-training checklist

Do not begin training with unusual chest pain, fever or marked weakness.

Warm up and adapt to the water gradually.

Never perform breath-hold training alone.

Do not use hyperventilation as a performance method.

Maintain hydration; sweating may be difficult to notice in water.

If symptoms occur, stop, surface and inform the team.

Seek sports-medicine or cardiology assessment when heart disease or suspicious symptoms are present.

Final note and references

Water is not an environment that simply “relaxes” or simply “stresses” the heart. Hydrostatic pressure, horizontal posture, exercise, breath-holding and temperature can act in different directions at the same time.

In healthy athletes, most changes remain within normal adaptive limits, and regular training can support cardiorespiratory fitness. Safety depends on distinguishing expected strain from warning signs and never dismissing unfamiliar symptoms.

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ESC Guidelines on Sports Cardiology and Exercise in Patients with Cardiovascular Disease.

UHMS Diving Medical Guidance to the Physician.

This guide is for general information and does not replace individual medical assessment or treatment.