

DEPARTMENT OF HYPERBARIC & DIVING MEDICINE ATHENS NAVAL HOSPITAL



Department of Hyperbaric and Diving Medicine
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Brief History

In Greece, reports of diving activities date back to the ancient years and diving has been historically linked to Kalymnos and sponge diving. Although diving casualties and cases of decompression sickness resulting in paraplegia and disability were counting hundreds during the first half of the 20th century, no initiative for Recompression Chamber usage took place until the 1950s.

Becoming member of **NATO** and formation of the first amphibious reconnaissance team of the Hellenic Navy led to acquisition of the **first Recompression Chamber** which was installed **aboard Hellenic Navy Ocean Salvage Vessel "SOTIR" in 1957**. This chamber had room to accommodate one patient at a time and its operation was dependent on the vessel's engines.

These obvious limitations were overcome after Hellenic Navy acquired a multi-place Recompression Chamber, installed at Piraeus Naval Hospital in 1963. Approximately ten years later, **Creta Naval Hospital** was equipped with a two-compartment Recompression Chamber and in 1981, the existing Piraeus Naval Hospital multi-place chamber was relocated at **Salamis Naval Hospital**.

The first systematic approach to organizing and staffing of the Diving & Hyperbaric Medicine department begins in Salamis in 1991, starting with specialization of medical and nursing personnel. In the same spirit, a dedicated building was constructed within the Athens Naval Hospital premises in 1997 to house the growing Department of Hyperbaric & Diving Medicine (DHDM). In 2004, DHDM acquired its modern multiplace recompression/hyperbaric chamber system which, being in operation since the beginning of 2005 has increased the treatment and research capabilities of the department, placing it in a high position concerning Hyperbaric Medicine internationally.

DHDM mission

DHDM of the Athens Naval Hospital offers treatment for all diving-related casualties in the area of Central and Southern Greece (mainland and islands), for Armed Forces and Law Enforcement Agencies. Also, for every civilian suffering from Decompression Sickness (covers approximately 70% of the country). It is the center of reference for evaluation of Fitness to Dive and appropriateness for diving duty for divers, special operations personnel, submariners offering medical support for all related diving activities (Armed Forces and Law Enforcement Agencies).

DHDM offers Hyperbaric Oxygen Therapy (HBOT) for patients admitted to Athens Naval Hospital, and Armed Forces personnel and their beneficiaries. Treatment is also available to inpatients of Athens public hospitals (non-beneficiaries) for appropriate indications, such as:

Arterial Gas Embolism

Decompression Sickness

Carbon Monoxide Poisoning

Necrotizing Soft-tissue Infections (Clostridial Myositis and Myonecrosis)

Post-radiation injury (soft-tissue and bones lesions after radiation therapy for cancer)

Delayed Wound Healing

Chronic Wounds (eg. Diabetic foot wounds and infections)

Chronic Refractory Osteomyelitis

Compromised grafts and flaps

Burns

Crush injury, Compartment syndrome & other acute traumatic ischemias

Idiopathic Sudden Sensori-Neural Hearing Loss

DHDM offers advice on diving research and best practices for diving safety. It has an active role during Hellenic Navy exercises, and if needed, is ready to offer treatment after submarine crew rescue. The Department is actively involved in training medical personnel and submarine crews on submarine escape and rescue and best practices for corresponding medical support.

Athens Naval Hospital's multiplace recompression/hyperbaric chamber system is a key-factor in supporting Hellenic and NATO submarine activities within national waters and supports Search and Rescue in the Southeast Mediterranean Sea.

It conducts research aiming to improve provision of health-related services within the Department in accordance to international practices.

The Department organizes conferences, seminars and training programs following continuous medical education.

DHDM tasks, on an annual basis, include:

Diving Accidents treatment and management: approximately 30 cases

Hyperbaric Oxygen Therapy: approximately 300 patients / at least 2.500 HBOT sessions (have reached 4.500 sessions)

Diver Candidate Pressure Tests: More than 400 (including diver candidates, special operations and submarine personnel).

Recompression Chamber readiness: approximately 300 days

Representation at the NATO Submarine Escape & Rescue Working Group (SMERWG).

Annual Diving & Hyperbaric Medicine Seminar with maximum 35 participants: Theoretical part duration is 3 weeks. Aim of the seminar is to offer graduates the basic training in Diving & Hyperbaric Medicine so they can suspect, make an initial diagnosis of a diving casualty, provide first aid and initiate treatment. Also, to familiarize with Hyperbaric Oxygen Therapy and its uses. This seminar takes place every year on May and is organized by the Athens Naval Hospital / Directorate of Education & Research and is similar to level 2D course according to ECHM-EDTC Educational and Training Standards for Diving and Hyperbaric Medicine.

DHDM has been recognized as accredited training facility to provide full (2-years) Hyperbaric Medicine fellowship (Government Official Gazette FEK 5490/B/06-12-2018)

International (English-speaking) Diving & Hyperbaric Medicine Course in the context of Military Cooperation Programs.

Educational demonstrations of the facility, Officer's and Petty Officer's Training programs on Diving & Hyperbaric Medicine.

We share therapeutic protocols with the majority of tertiary hospitals of Athens and collaborate clinically with more than 20 medical specialties.

Hyperbaric Oxygen Therapy

Hyperbaric Oxygen Therapy (HBOT) is defined as breathing pure oxygen inside a treatment chamber where ambient pressure is increased. It takes place in these specially constructed chambers called hyperbaric or recompression chambers and can be mono-place or multi-place (more than one patient treated simultaneously). Pressure inside multi-place hyperbaric chambers increases with addition of air and oxygen is delivered to the patients as they breathe through airtight fitted masks or hoods.

During HBOT, oxygen content in the blood increases. As explained by physics and the gas laws, the amount of a gas dissolved in a liquid depends on the partial pressure of the gas. By increasing the gas partial pressure, the amount of it that enters blood plasma (liquid) increases proportionally. HBOT conditions do that by increasing both total pressure and proportion of oxygen (pure oxygen breathing). This allows oxygen provision to body parts with poor blood supply, either because of vascular problems (eg. Diabetic microvasculopathy – atheromatosis

with partial vascular obstruction etc) or because of tissue injury compromising oxygen perfusion (eg. swelling caused by direct injury, burns, compartment syndrome etc). HBOT normalizes oxygen delivery to the tissues, because oxygen gradient (pressure difference) between blood vessel and the tissue regulates the distance oxygen can travel and its ability to overcome obstacles, like edema or capillary thickening in diabetes

Multiplace Recompression Chamber System

Acquisition of the latest technology multiplace recompression chamber complex by the Hellenic Navy made DHDM/ANH a highly specialized and fully operational diving medicine facility with 24/7 readiness. The Department's system is one of the top in Europe and worldwide. The main characteristics of DHDM/ANH chamber system that make it different from other recompression chambers in the country are:

- The main part of the system consists of three recompression chambers that connect with each other (all other installations consist of single chambers) and have the capability to coordinate their operation with the use of computerized systems.
- Increased capacity, as it is possible to treat 24 patients simultaneously. It is designed to accommodate disabled-bedridden patients (as in severe decompression sickness) and is able to accommodate many cases, as can be the case in massive diving accident or after rescuing national or NATO submarine crew. Total maximum capacity in all 3 chambers reaches 37 individuals.
- Has the only chambers in Greece able to reach maximum operating pressure equal to 240 msw depth (25 ATA). Compression can be accomplished using mixture of gases, maximizing treatment potential for diving casualties and support of "demanding" deep sea diving.
- Has the only chamber in Greece able to simulate diving (part of it fills up with water), offering the capability to test diving devices or new applications in a controlled environment.

The highly specialized – dedicated staff of the Department of Hyperbaric & Diving Medicine with over 20 years of presence in the Hellenic Navy, operating for over 15 years the existing multiplace recompression chamber system has created tradition in delivering high-quality medical services.