EUBS European Underwater and Baromedical Society

ABSTRACT BOOK

14-18 September 2026

50TH ANNUAL SCIENTIFIC MEETING OF EUBS

Geneva, Switzerland

Welcome Letter

~ Word from the organizing committee ~

Dear colleagues, dear friends,

It is with immense pride that the organizing committee welcomes you to the 50th EUBS Scientific Congress, held this year in Geneva.

Hosting this very special anniversary of our society is a considerable honour for us. Seeing specialists in hyperbaric and underwater medicine converge on our city from all four corners of the world – clinicians, researchers, physiologists, professional divers – testifies to the vitality and international reach of our discipline. Each and every one of you, through your expertise and dedication, helps make this congress a landmark moment in the history of the EUBS.

This anniversary edition carries an added significance with the organization, on the very first day, of the ECHM (European Committee for Hyperbaric Medicine) consensus conference. Hosting this event in Geneva is a rare privilege, and we are fully aware of the responsibility that comes with welcoming a discussion so central to shaping the future indications of our specialty.

We are delighted to welcome you to a city that has always embodied the spirit of international cooperation, scientific rigour, and medical excellence. Geneva, home to the world's leading health organizations, offers a natural setting for these exchanges, and we hope you will find here that local expertise – precision, hospitality, and openness to the world – that characterizes our region.

This congress is the result of collective work carried out with passion over many months. We wish to express our deepest gratitude to the EUBS Executive Committee for its trust and unwavering support throughout the preparation of this event, as well as to the entire team of the Hyperbaric and Underwater Medicine Unit (UMSH) at the HUG, whose daily commitment and dedication made this 50th edition possible.

We wish you all a congress rich in scientific exchange, human encounters, and discovery.

Thomas Schaller
The EUBS 2026 Organizing Committee

Welcome Letter

~ Word from the EUBS President ~

Dear colleagues and members of the European Underwater Baromedical Society (EUBS),

On behalf of the EUBS Executive Committee, I am delighted to welcome you to Geneva for our 50th Annual Scientific Meeting. It's a pleasure to be back in Geneva ten years after our 2016 conference for a truly exceptional occasion as we gather to celebrate our Golden Jubilee.

Building upon the high scientific standards set by our previous meetings, this year's congress aims to further elevate the quality of our scientific discussions and advance our shared knowledge. This year's conference will cover a remarkably diverse range of topics, reflecting the broad scope and continuous evolution of underwater and hyperbaric medicine—from fundamental physiology to clinical applications.

Beyond the lecture halls, Geneva is a vibrant city that offers an ideal setting for our gathering. Alongside our intensive scientific schedule, the local committee has prepared a rich social program. I hope this meeting will provide a good opportunity to connect with colleagues, establish new collaborations, and enjoy everything Geneva has to offer.

I would like to express my sincere gratitude to the organizing committee, keynote speakers, authors, reviewers, and corporate sponsors whose hard work and support have made this 50th anniversary meeting possible.

Thank you for being part of this historic milestone. I wish you all a productive, inspiring, and enjoyable conference in Geneva!

Warm regards

Bengusu Mirasoglu
President of the European Underwater Baromedical Society (EUBS)

EUBS 2026 Annual Scientific Meeting

~ Organizing committee ~

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Gerardo Bosco (Italy)
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John Peters (Executive Director UHMS, USA)

~ Scientific committee ~

General secretariat
Justine Bernard
Rodrigue Pignel
Thomas Schaller
Alice Varichon
And all the team of the Geneva hyperbaric unit (HUG)

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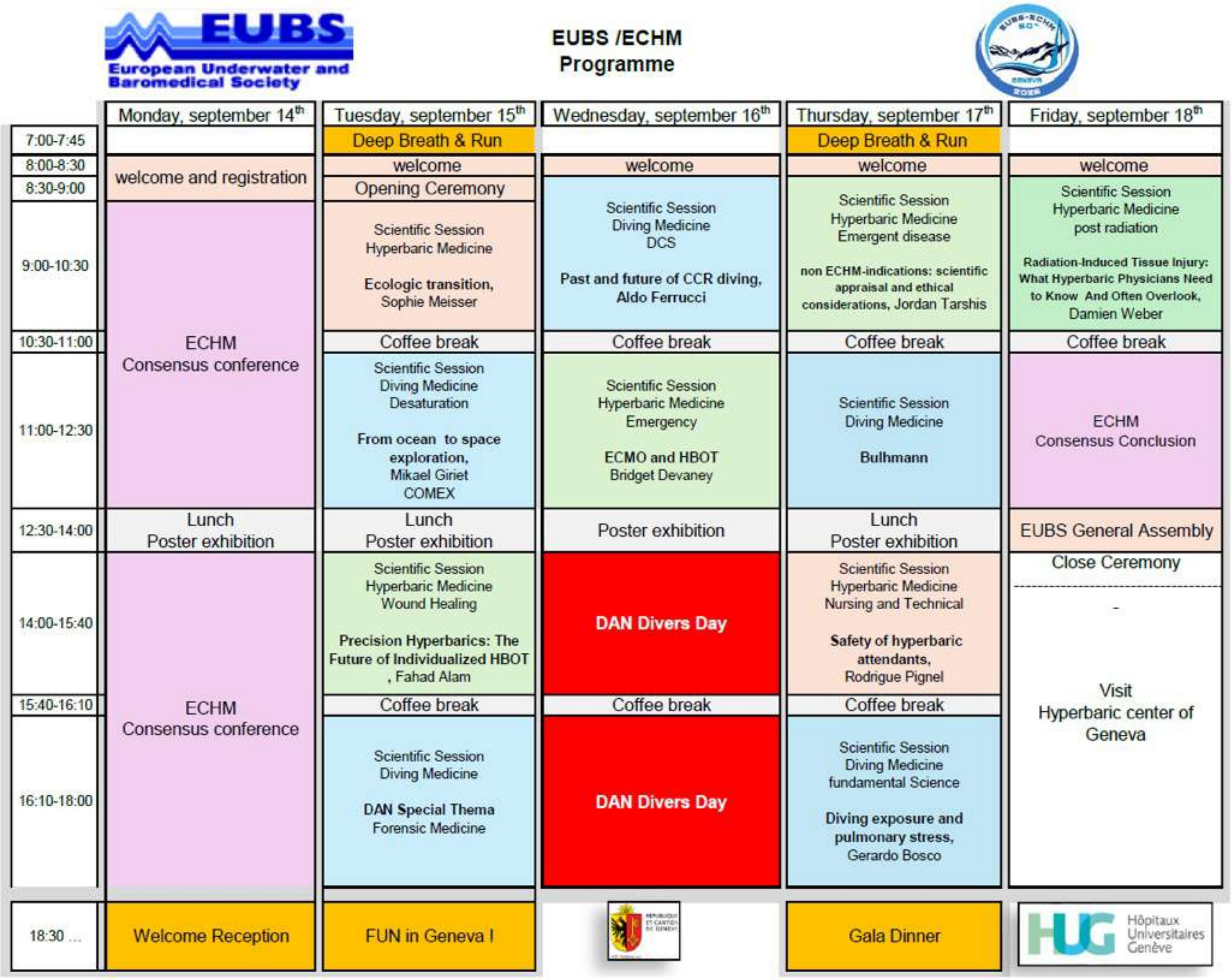
HYPCOM

Conference & Session Schedule

General Program Overview



EUBS /ECHM
Programme

	Monday, september 14th	Tuesday, september 15th	Wednesday, september 16th	Thursday, september 17th	Friday, september 18th
7:00-7:45		Deep Breath & Run		Deep Breath & Run	
8:00-8:30	welcome and registration	welcome	welcome	welcome	welcome
8:30-9:00		Opening Ceremony	Scientific Session Diving Medicine DCS **Past and future of CCR diving, Aldo Ferrucci**	Scientific Session Hyperbaric Medicine Emergent disease **non ECHM-indications: scientific appraisal and ethical considerations, Jordan Tarshis**	Scientific Session Hyperbaric Medicine post radiation **Radiation-Induced Tissue Injury: What Hyperbaric Physicians Need to Know And Often Overlook,** Damien Weber
9:00-10:30	ECHM Consensus conference	Scientific Session Hyperbaric Medicine **Ecologic transition,** Sophie Meisser			
10:30-11:00		Coffee break	Coffee break	Coffee break	Coffee break
11:00-12:30		Scientific Session Diving Medicine Desaturation **From ocean to space exploration,** Mikael Giriet COMEX	Scientific Session Hyperbaric Medicine Emergency **ECMO and HBOT** Bridget Devaney	Scientific Session Diving Medicine **Bulhmann**	ECHM Consensus Conclusion
12:30-14:00	Lunch Poster exhibition	Lunch Poster exhibition	Poster exhibition	Lunch Poster exhibition	EUBS General Assembly
14:00-15:40	ECHM Consensus conference	Scientific Session Hyperbaric Medicine Wound Healing **Precision Hyperbarics: The Future of Individualized HBOT** , Fahad Alam	**DAN Divers Day**	Scientific Session Hyperbaric Medicine Nursing and Technical **Safety of hyperbaric attendants,** Rodrigue Pignel	Close Ceremony - Visit Hyperbaric center of Geneva
15:40-16:10		Coffee break	Coffee break	Coffee break	
16:10-18:00		Scientific Session Diving Medicine **DAN Special Thema** Forensic Medicine	**DAN Divers Day**	Scientific Session Diving Medicine fundamental Science **Diving exposure and pulmonary stress,** Gerardo Bosco	
18:30 …	Welcome Reception	FUN in Geneva !		Gala Dinner	

Monday, September 14th, 2026

ECHM Consensus Conference

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Geneva, september 14 -18 , 2026

Monday, September 14th

08:00-09:00	**Welcome coffee and Registration**		
09:00-09:10	**Introduction**	Introduction	J. Kot
09:10-09:20		Consensus Conference methodology	A. Kjellberg
09:20-09:30		Mechanisms of action of HBO	C. Balestra, CM. Muth
09:30-09:40	**Accepted indications: Type I recommandations**	Dysbaric Illness	A. Marroni
09:40-09:50		Non-dysbaric gas embolism	PJ. Van Ooij
09:50-10:00		Tissue infections	O. Hyldegaard
10:00-10:10		Carbon monoxyde oisoning	J. Desola
10:10-10:20		Crush syndrom	I. Millar
10:20-10:30		Sudden deafness	P. Germonpre
10:30-10:40		Radiation-related injury	J. Kot
10:40-11:00		**General discussion & Voting**	
11:00-11:10 11:10-11:20	Coffee break		
11:20-11:30	**Accepted indications: Type II and III recommandations**	Diabetic foot lesions	P. Longobardi
11:30-11:40		Delayed wound healing	P. Longobardi
11:40-11:50		Compromised skin graft and musculo-cutaneous flap	J. Kot
11:50-12:00		Femoral head necrosis	G. Bosco
12:00-12:10		Refractory chronic osteomyelitis	K. Hamiller
12:10-12:20		Burns	P. Germonpre
12:20-12:30		Central retinal artery occlusion	J. Desola
12:30-13:00		**General discussion & Vote**	
13:00-14:00	Lunch - Exhibition - Posters		
14:00-14:10	**Emerging indications**	Inflammatory Bowel Disease	S. Boet
14:10-14:20		COVID-19 (acute and long)	A. Kjellberg
14:20-14:30		Neurologic conditions	JE. Blatteau
14:30-15:10		Other non accepted and emerging indications	R. Pignel, J. Kot
15:10-15:30		**General discussion & Voting**	
15:30-16:00	Coffee break - Exhibition - Posters		
16:00-16:10	**Practice of HBO**	Organisation, operation and safety of HBOT	J. Kot, F. Burman
16:10-16:20		Contre indication of HBOT	B. Mirasoglu
16:20-16:30		Medical staff education and training	J. Kot, J. Wendling, J. Desola
16:30-16:40		Non-medical staff education and training	K. Gaitanou, EBAss
16:40-16:50		Choosing of recompression schedule	JE. Blatteau
16:50-17:00		Dosing of HBOT	J. Kot
17:00-17:10		Research	C. Balestra, P. Germonpre
17:10-17:20		Cost of HBOT	P. longobardi
17:20-18:00	**General discussion and closing**		
18:00-20:00	**Welcome reception**		

Tuesday, September 15th, 2026

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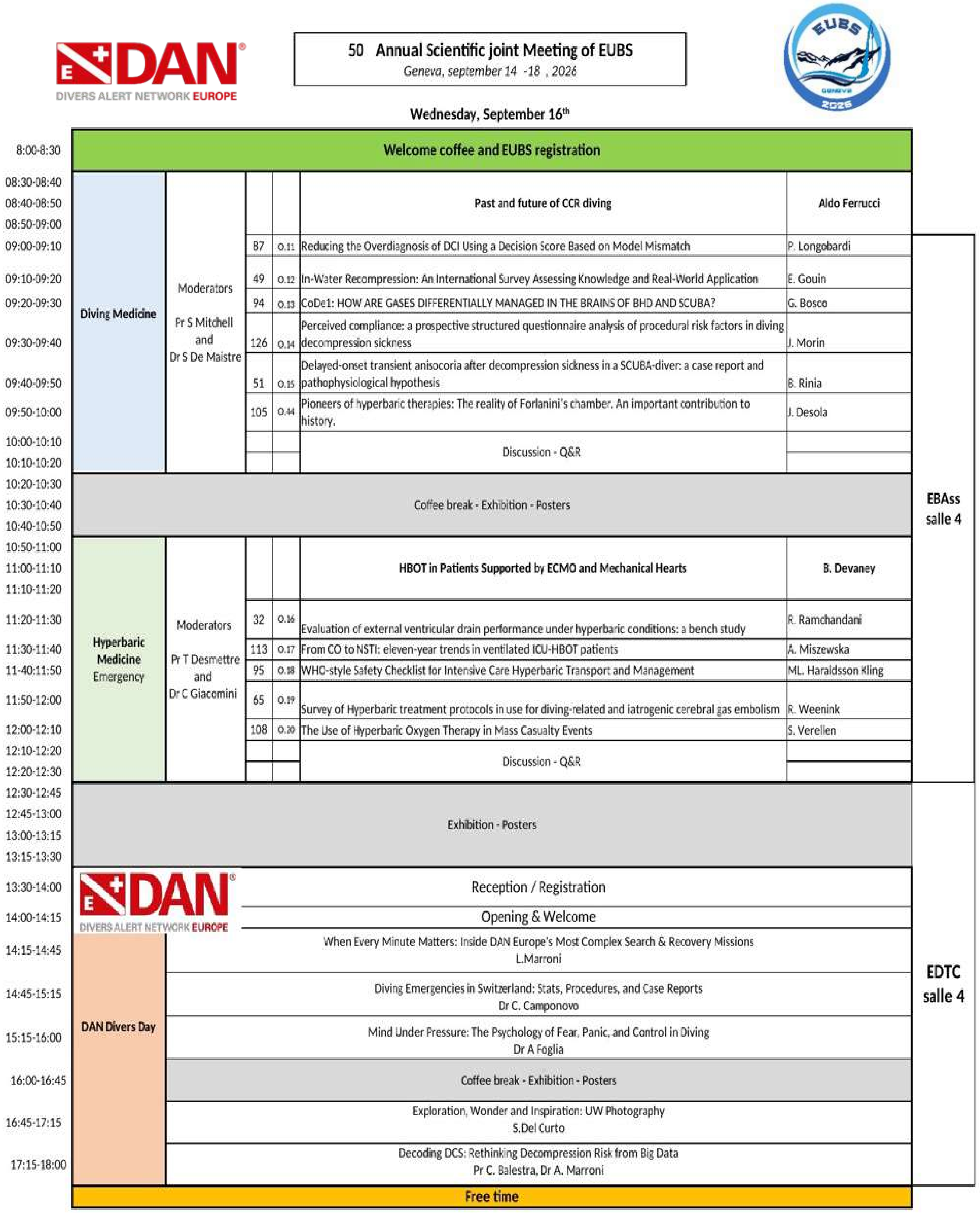
Tuesday, September 15th

07:00-08:00	**DEEP BREATH AND RUN**					
8:00-8:30	**Welcome coffee and EUBS registration**					
08:30-08:45	**EUBS Welcome Ceremony**					
08:45-09:00						
09:00-09:15	**HBO** Ecology Transition	Moderator Pr Y Jackson			**Ecologic Transition**	**S. Meisser**
09:15-09:30					ET in the Hospital	I. Da Ernestho
09:30-09:45					ET in the Hyperbaric Unit	A. Varichon
09:45-10:00					ET of hyperbaric system	R. Pignel
10:00-10:15					ET in a congress	A. Varichon
10:15-10:30			Discussion - Q&R			
10:30-10:45	Coffee break - Exhibition - Posters					
10:40-10:50						
10:50-11:00						
11:00-11:10	**Diving Medicine**	Moderators Pr JE Blatteau and Dr E Dugrenot			**Industry sponsored lecture: From ocean to space exploration (COMEX)**	**M. Giret (COMEX)**
11:10-11:20						
11:20-11:30						
11:30-11:40			34	O.1	Comparative Decompression Sickness Incidence and Microparticles Release in Heliox vs. Nitrox Simulated Dives in Rats	J. Orsat
11-40:11:50			46	O.2	Autonomic Nervous System Responses to Decompression Stress. A preliminary study	R. Pelliccia
11:50-12:00			96	O.3	Occupational Health Surveillance and Risk Management in Hyperbaric Tunnel Excavation: The Casalnuovo Project	G. Bosco
12:00-12:10			67	O.4	Psychotropic medication use in divers: prevalence, clinical and psychological implications	C. Ferri
12:10-12:20					Discussion - Q&R	
12:20-12:30						
12:30-12:45	Lunch - Exhibition - Posters					
12:45-13:00						
13:00-13:15						
13:15-13:30						
13:30-13:45						
13:45-14:00						
14:00-14:10	**Hyperbaric Medicine**	Moderators Pr B Mirasoglu and Dr S Ordies			**Lecture: Precision Hyperbarics: The Future of Individualized HBOT**	**F. Alam**
14:10-14:20						
14:20-14:30						
14:30-14:40			80	O.5	Frequency and magnitude of Myopic shift in Hyperbaric oxygen treatment: A systematic review.	B. Müller
14:40-14:50			45	O.6	Ten hyperbaric oxygen sessions in five versus ten days for acute acoustic trauma: randomised trial	N. Risvanoglu
14:50-15:00			11	O.7	Exploring the Efficacy of Hyperbaric Oxygen Therapy for Severe Motor Deficit following Spine Surgery	E. Tang
15:00-15:10			122	O.8	Hyperbaric oxygen therapy for post-COVID-19: one-year outcomes of a prospective cohort study	L. Esteve Cuevas
15:10-15:20			124	O.9	NHBOT: A Retrieval-Augmented AI Knowledge Assistant for Hyperbaric Medicine	N. Ozyilmaz
15-20-15:30			Discussion - Q&R			
15:30-15:40						
15:40-15:50	Coffee break - Exhibition - Posters					
15:50-16:00						
16:00-16:10						
16:10-16:30	**Diving Medicine** DAN Special Thema Forensic Medicine	Moderators			**DAN: Forensic medicine in diving medicine**	
16:30-16:40					Introduction	L. Marroni
16:40-16:50						
16:50-17:00					Diving Fatalities: Current Trends and Emerging Insights from DAN Surveillance	F. Tillmans
17:00-17:10						
17:10-17:20					Forensic Investigation of Diving Fatalities	V. Rybárová
17:20-17:30					Technical Investigation of Fatal Diving Accidents	G. Paparo
17:30-17:40						
17:40-17:50						
17:50-18:00			99	O.10	When the Chain Breaks: The Limits of Investigation in a CCR Diving Fatality	V. Rybárová
19:00 ...	**FUN in Geneva**					

Wednesday, September 16th, 2026



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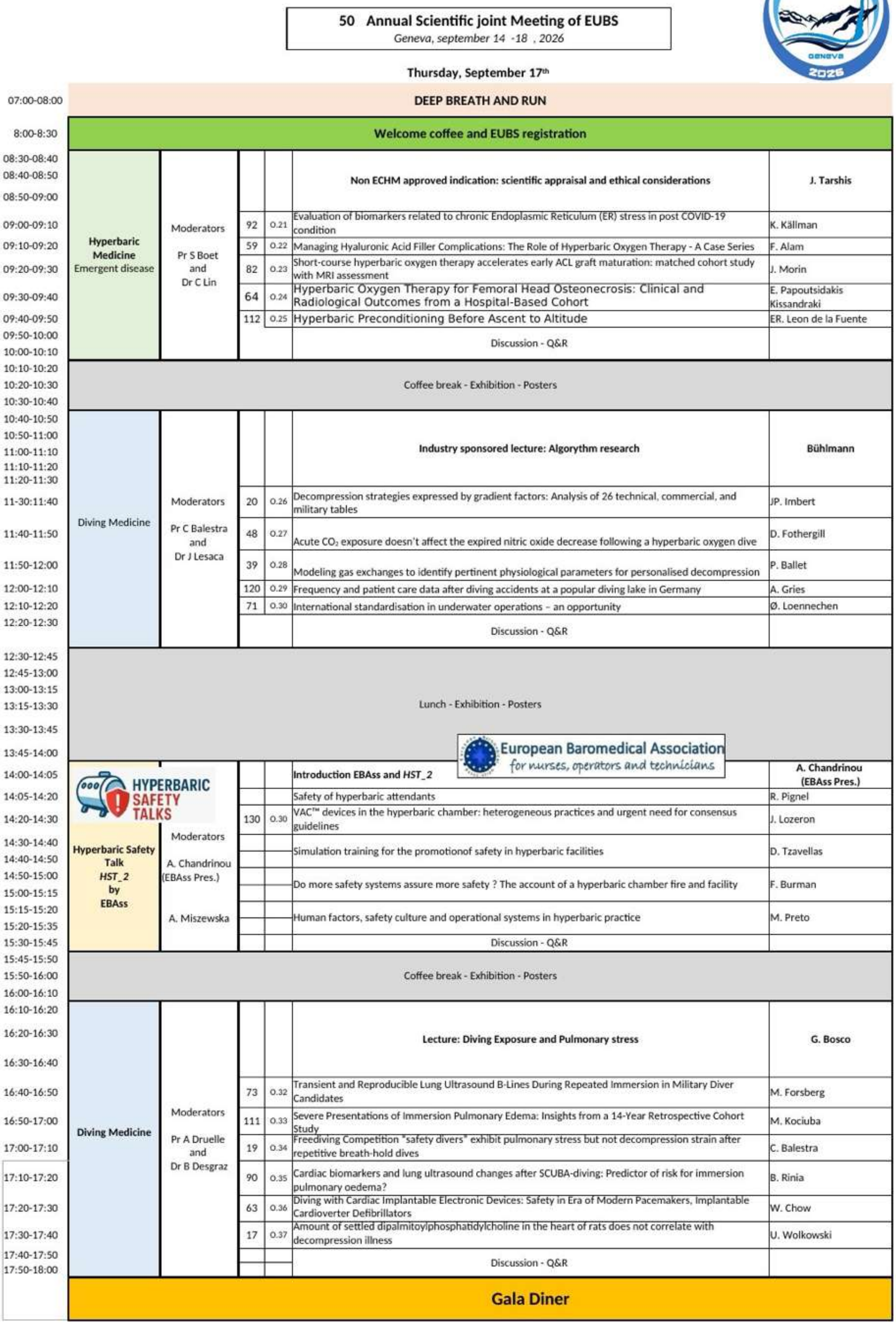
Wednesday, September 16th

8:00-8:30	**Welcome coffee and EUBS registration**						
08:30-08:40	**Diving Medicine**	Moderators Pr S Mitchell and Dr S De Maistre			**Past and future of CCR diving**	**Aldo Ferrucci**	
08:40-08:50							
08:50-09:00							
09:00-09:10			87	0.11	Reducing the Overdiagnosis of DCI Using a Decision Score Based on Model Mismatch	P. Longobardi	**EBAss salle 4**
09:10-09:20			49	0.12	In-Water Recompression: An International Survey Assessing Knowledge and Real-World Application	E. Gouin	
09:20-09:30			94	0.13	CoDe1: HOW ARE GASES DIFFERENTIALLY MANAGED IN THE BRAINS OF BHD AND SCUBA?	G. Bosco	
09:30-09:40			126	0.14	Perceived compliance: a prospective structured questionnaire analysis of procedural risk factors in diving decompression sickness	J. Morin	
09:40-09:50			51	0.15	Delayed-onset transient anisocoria after decompression sickness in a SCUBA-diver: a case report and pathophysiological hypothesis	B. Rinia	
09:50-10:00			105	0.44	Pioneers of hyperbaric therapies: The reality of Forlanini's chamber. An important contribution to history.	J. Desola	
10:00-10:10					Discussion - Q&R		
10:10-10:20							
10:20-10:30	Coffee break - Exhibition - Posters						
10:30-10:40							
10:40-10:50							
10:50-11:00	**Hyperbaric Medicine** Emergency	Moderators Pr T Desmettre and Dr C Giacomini			**HBOT in Patients Supported by ECMO and Mechanical Hearts**	**B. Devaney**	
11:00-11:10							
11:10-11:20							
11:20-11:30			32	0.16	Evaluation of external ventricular drain performance under hyperbaric conditions: a bench study	R. Ramchandani	
11:30-11:40			113	0.17	From CO to NSTI: eleven-year trends in ventilated ICU-HBOT patients	A. Miszewska	
11-40:11:50			95	0.18	WHO-style Safety Checklist for Intensive Care Hyperbaric Transport and Management	ML. Haraldsson Kling	
11:50-12:00			65	0.19	Survey of Hyperbaric treatment protocols in use for diving-related and iatrogenic cerebral gas embolism	R. Weenink	
12:00-12:10			108	0.20	The Use of Hyperbaric Oxygen Therapy in Mass Casualty Events	S. Verellen	
12:10-12:20					Discussion - Q&R		
12:20-12:30							
12:30-12:45	Exhibition - Posters						**EDTC salle 4**
12:45-13:00							
13:00-13:15							
13:15-13:30							
13:30-14:00	**DAN Divers Day**				Reception / Registration		
14:00-14:15					Opening & Welcome		
14:15-14:45					When Every Minute Matters: Inside DAN Europe's Most Complex Search & Recovery Missions L.Marroni		
14:45-15:15					Diving Emergencies in Switzerland: Stats, Procedures, and Case Reports Dr C. Camponovo		
15:15-16:00					Mind Under Pressure: The Psychology of Fear, Panic, and Control in Diving Dr A Foglia		
16:00-16:45					Coffee break - Exhibition - Posters		
16:45-17:15					Exploration, Wonder and Inspiration: UW Photography S.Del Curto		
17:15-18:00					Decoding DCS: Rethinking Decompression Risk from Big Data Pr C. Balestra, Dr A. Marroni		
	Free time						

Thursday, September 17th, 2026



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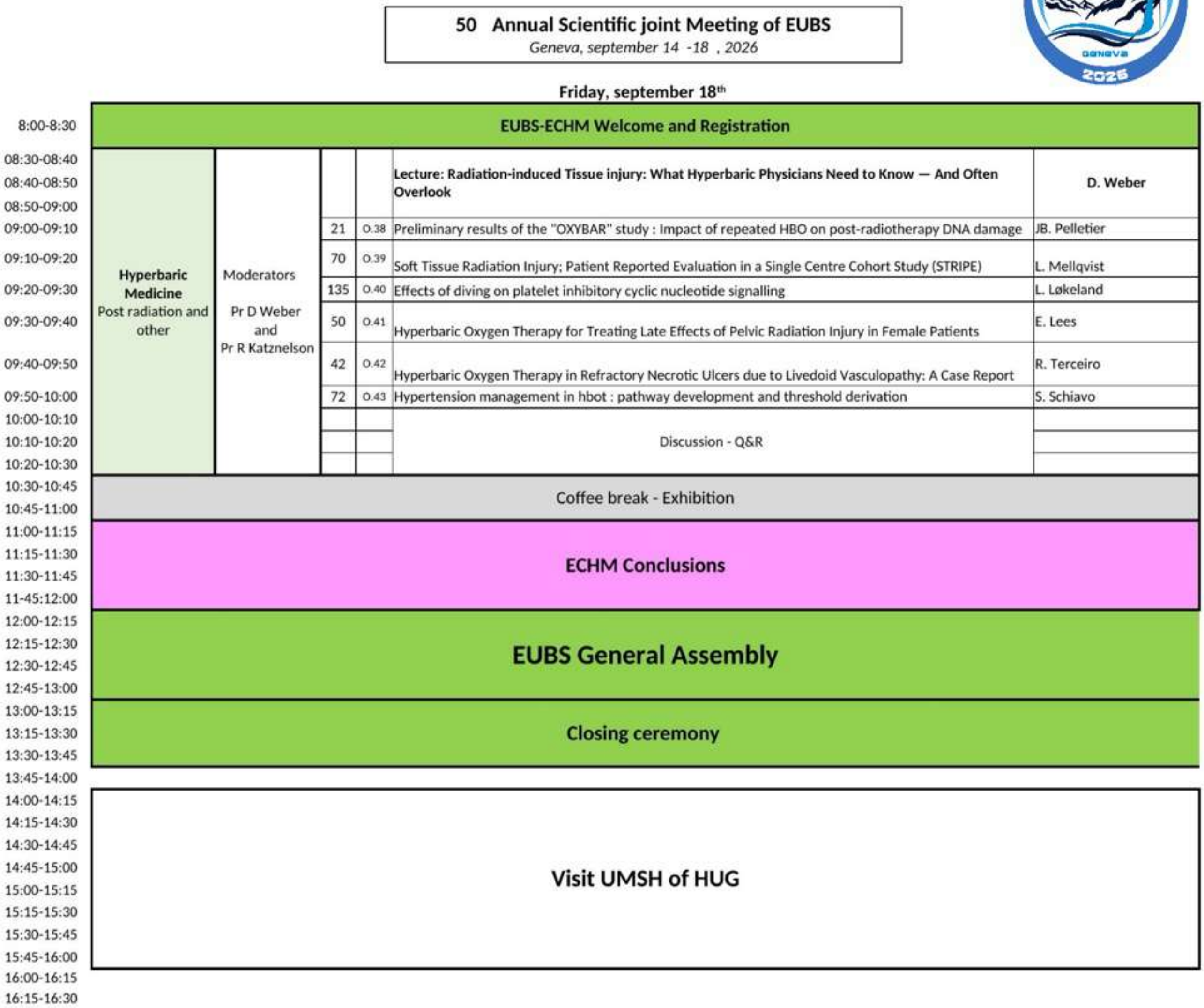
EUBS 50th Geneva 2026

Thursday, September 17th

07:00-08:00	**DEEP BREATH AND RUN**					
8:00-8:30	**Welcome coffee and EUBS registration**					
08:30-08:40	**Hyperbaric Medicine** Emergent disease	Moderators Pr S Boet and Dr C Lin			**Non ECHM approved indication: scientific appraisal and ethical considerations**	**J. Tarshis**
08:40-08:50						
08:50-09:00						
09:00-09:10			92	0.21	Evaluation of biomarkers related to chronic Endoplasmic Reticulum (ER) stress in post COVID-19 condition	K. Källman
09:10-09:20			59	0.22	Managing Hyaluronic Acid Filler Complications: The Role of Hyperbaric Oxygen Therapy - A Case Series	F. Alam
09:20-09:30			82	0.23	Short-course hyperbaric oxygen therapy accelerates early ACL graft maturation: matched cohort study with MRI assessment	J. Morin
09:30-09:40			64	0.24	Hyperbaric Oxygen Therapy for Femoral Head Osteonecrosis: Clinical and Radiological Outcomes from a Hospital-Based Cohort	E. Papoutsidakis Kissandraki
09:40-09:50			112	0.25	Hyperbaric Preconditioning Before Ascent to Altitude	ER. Leon de la Fuente
09:50-10:00					Discussion - Q&R	
10:00-10:10						
10:10-10:20	Coffee break - Exhibition - Posters					
10:20-10:30						
10:30-10:40						
10:40-10:50	Diving Medicine	Moderators Pr C Balestra and Dr J Lesaca			**Industry sponsored lecture: Algorythm research**	**Bühlmann**
10:50-11:00						
11:00-11:10						
11:10-11:20						
11:20-11:30						
11-30:11:40			20	0.26	Decompression strategies expressed by gradient factors: Analysis of 26 technical, commercial, and military tables	JP. Imbert
11:40-11:50			48	0.27	Acute CO_2 exposure doesn't affect the expired nitric oxide decrease following a hyperbaric oxygen dive	D. Fothergill
11:50-12:00			39	0.28	Modeling gas exchanges to identify pertinent physiological parameters for personalised decompression	P. Ballet
12:00-12:10			120	0.29	Frequency and patient care data after diving accidents at a popular diving lake in Germany	A. Gries
12:10-12:20			71	0.30	International standardisation in underwater operations – an opportunity	Ø. Loennechen
12:20-12:30					Discussion - Q&R	
12:30-12:45	Lunch - Exhibition - Posters					
12:45-13:00						
13:00-13:15						
13:15-13:30						
13:30-13:45						
13:45-14:00					European Baromedical Association *for nurses, operators and technicians*	
14:00-14:05	HYPERBARIC SAFETY TALKS **Hyperbaric Safety Talk** ***HST_2*** **by** **EBAss**	Moderators A. Chandrinou (EBAss Pres.) A. Miszewska			**Introduction EBAss and *HST_2***	**A. Chandrinou (EBAss Pres.)**
14:05-14:20					Safety of hyperbaric attendants	R. Pignel
14:20-14:30			130	0.30	VAC™ devices in the hyperbaric chamber: heterogeneous practices and urgent need for consensus guidelines	J. Lozeron
14:30-14:40					Simulation training for the promotionof safety in hyperbaric facilities	D. Tzavellas
14:40-14:50						
14:50-15:00					Do more safety systems assure more safety ? The account of a hyperbaric chamber fire and facility	F. Burman
15:00-15:15						
15:15-15:20					Human factors, safety culture and operational systems in hyperbaric practice	M. Preto
15:20-15:35						
15:30-15:45					Discussion - Q&R	
15:45-15:50	Coffee break - Exhibition - Posters					
15:50-16:00						
16:00-16:10						
16:10-16:20	**Diving Medicine**	Moderators Pr A Druelle and Dr B Desgraz			**Lecture: Diving Exposure and Pulmonary stress**	**G. Bosco**
16:20-16:30						
16:30-16:40						
16:40-16:50			73	0.32	Transient and Reproducible Lung Ultrasound B-Lines During Repeated Immersion in Military Diver Candidates	M. Forsberg
16:50-17:00			111	0.33	Severe Presentations of Immersion Pulmonary Edema: Insights from a 14-Year Retrospective Cohort Study	M. Kociuba
17:00-17:10			19	0.34	Freediving Competition "safety divers" exhibit pulmonary stress but not decompression strain after repetitive breath-hold dives	C. Balestra
17:10-17:20			90	0.35	Cardiac biomarkers and lung ultrasound changes after SCUBA-diving: Predictor of risk for immersion pulmonary oedema?	B. Rinia
17:20-17:30			63	0.36	Diving with Cardiac Implantable Electronic Devices: Safety in Era of Modern Pacemakers, Implantable Cardioverter Defibrillators	W. Chow
17:30-17:40			17	0.37	Amount of settled dipalmitoylphosphatidylcholine in the heart of rats does not correlate with decompression illness	U. Wolkowski
17:40-17:50					Discussion - Q&R	
17:50-18:00						
	Gala Diner					

Friday, September 18th, 2026



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Friday, september 18th

8:00-8:30	**EUBS-ECHM Welcome and Registration**					
08:30-08:40	**Hyperbaric Medicine** Post radiation and other	Moderators Pr D Weber and Pr R Katznelson			**Lecture: Radiation-induced Tissue injury: What Hyperbaric Physicians Need to Know — And Often Overlook**	**D. Weber**
08:40-08:50						
08:50-09:00						
09:00-09:10			21	0.38	Preliminary results of the "OXYBAR" study : Impact of repeated HBO on post-radiotherapy DNA damage	JB. Pelletier
09:10-09:20			70	0.39	Soft Tissue Radiation Injury; Patient Reported Evaluation in a Single Centre Cohort Study (STRIPE)	L. Mellqvist
09:20-09:30			135	0.40	Effects of diving on platelet inhibitory cyclic nucleotide signalling	L. Løkeland
09:30-09:40			50	0.41	Hyperbaric Oxygen Therapy for Treating Late Effects of Pelvic Radiation Injury in Female Patients	E. Lees
09:40-09:50			42	0.42	Hyperbaric Oxygen Therapy in Refractory Necrotic Ulcers due to Livedoid Vasculopathy: A Case Report	R. Terceiro
09:50-10:00			72	0.43	Hypertension management in hbot : pathway development and threshold derivation	S. Schiavo
10:00-10:10					Discussion - Q&R	
10:10-10:20						
10:20-10:30						
10:30-10:45	Coffee break - Exhibition					
10:45-11:00						
11:00-11:15	**ECHM Conclusions**					
11:15-11:30						
11:30-11:45						
11-45:12:00						
12:00-12:15	**EUBS General Assembly**					
12:15-12:30						
12:30-12:45						
12:45-13:00						
13:00-13:15	**Closing ceremony**					
13:15-13:30						
13:30-13:45						
13:45-14:00						
14:00-14:15	**Visit UMSH of HUG**					
14:15-14:30						
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16:15-16:30						

Oral Presentations

EUBS2026-O.01

Comparative Decompression Sickness Incidence and Microparticles Release in Heliox vs. Nitrox Simulated Dives in Rats

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Background and Aims: Decompression sickness (DCS) is driven by gas bubble formation and a subsequent thromboinflammatory response. Extracellular vesicles and especially microparticles (MPs) have emerged as potential mediators of this inflammatory cascade. While the physical properties of helium and nitrogen are well documented, the biological impact of the release and content of MPs remains poorly understood. This study aims to evaluate DCS outcomes and characterise MP subtypes in a rat model using identical heliox and nitrox profiles.

Methods: Male Sprague Dawley rats (n=12 per group) were subjected to simulated dives in a 40-liter hyperbaric chamber. Animals were compressed at 200 kPa/min to a pressure of 700 kPa for a 90-minute bottom time. Decompression was conducted at 50 kPa/min to atmospheric pressure. Two gas mixtures were compared: Nitrox 21% (79% N_2, 21% O_2) and Heliox 21% (79% He, 21% O_2). Following decompression, rats were observed for 60 minutes for clinical signs of DCS and blood was collected for MPs isolation. These rats were compared with control rats exposed to the same gas at atmospheric pressure (n=6 per group). Characterization included flow cytometry for thromboinflammatory markers, including P-selectin, Tissue Factor (CD142), Phalloidin, and Thrombospondin.

Results: Experimental runs demonstrated a significant difference in DCS incidence between the two gas mixtures despite identical pressure-time profiles. Nitrox 21% dives resulted in a severe DCS rate of 83%, whereas Heliox 21% dives resulted in a substantially lower rate of 33%. Flow cytometry analysis highlights a significantly higher concentration of MPs in the plasma after a nitrogen dive compared to a helium dive ($p = 0.0056$). Among all markers analysed, CD142 and phalloidin were predominantly expressed on MPs. Plasma concentrations of $CD142^+$ MPs and $phalloidin^+$ MPs were both significantly increased after nitrogen diving compared to helium diving ($p = 0.0072$ for each). Further analyses, including their OMICS content (proteins, mRNA, miRNA), are ongoing to complete these findings.

Conclusions: In this rat model, helium-based decompression resulted in a lower incidence of DCS associated with a decrease in pro-inflammatory/coagulant MPs. Ongoing analysis of MPs subtypes should further elucidate whether helium mitigates the thrombo-inflammatory response typically triggered by nitrogen-based bubbles.

EUBS2026-O.02

Autonomic Nervous System Responses to Decompression Stress. A Preliminary Study

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Background and Aims: Decompression stress in scuba diving, venous gas emboli (VGE) and autonomic nervous system (ANS) modulation remains incompletely understood. Heart rate variability (HRV) a non-invasive marker of autonomic balance that may reflect physiological responses to decompression bubble related stress.

Methods: Seven experienced technical closed-circuit rebreather (CCR) divers (5 males, 2 females; mean age 38.0 ± 5.0 years; BMI 28.0 ± 4.5 kg/m²) performed daily dives in the Solomon Islands using trimix 10/35 (depth range 28.2–86.0 msw; mean runtime 171 ± 53.75 min). HRV was recorded pre and post dive using MoveSense Flash sensors and analyzed with Kubios HRV Premium v3.6.1. Post-dive VGE were graded at 30 and 45 minutes post-surfacing by transthoracic echocardiography (Eftedal–Brubakk scale). Divers were stratified into three groups: Bubble-Free (Grade 0; n = 14), Moderately Bubbling (Grades 1–2; n = 10), and Bubbling (Grades 3–5; n = 10).

Results: Bubble-Free divers produced no significant HRV changes. Moderately Bubbling divers elicited significant post-dive increases across all HRV metrics. In the Bubbling group, changes were largest and highly significant. The Baevsky Stress Index decreased significantly only in the Bubbling group, paralleled by a significant Parasympathetic Nervous System (PNS) Index increase and Sympathetic Nervous System (SNS) Index decrease.

Conclusions: These findings reveal a possible dose-response relationship between VGE burden and ANS modulation. The HRV and Stress Index changes likely reflect a compensatory vagal response. HRV monitoring may serve as a sensitive indicator of subclinical decompression stress in technical divers.

EUBS2026-O.03

Occupational Health Surveillance and Risk Management in Hyperbaric Tunnel Excavation: The Casalnuovo Project

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Background and Aims: The Casalnuovo tunnel, part of the Naples–Bari railway project, represents Italy's first application of hyperbaric excavation techniques to manage groundwater in a 650-meter section. Operating at pressures between 1.3 and 2.2 ATA, the project required a comprehensive Health and Safety Program (HSP) to mitigate physiological risks such as decompression sickness and barotrauma.

Methods: The Hyperbaric Health Plan (PSI) integrated clinical surveillance and specialized training. Workers underwent preventive medical exams (including exercise stress tests and spirometry) and bimonthly periodic checks. A 12-hour training program (10 hours theory, 2 hours practice in a hyperbaric chamber) was mandatory for all personnel. Medical support featured 24/7 on-call availability and on-site specialists for pressures exceeding 1.5 ATA. Scientific monitoring analyzed inflammatory biomarkers (IL-6, IL-1β), alveolar integrity, and intravascular bubbles via cardiac Doppler ultrasound.

Results: Throughout 18 months, 19,881 entries were recorded. Only 41 workers reported mild symptoms, predominantly earache (21 cases), with only one instance of ear barotrauma requiring hospital investigation. Ultrasound assessments found mild bubble formation (EB grade 1) in 24% of subjects. Biomarker analysis showed increases in IL-6, IL-1β, and glutamate, suggesting neurophysiological fatigue and systemic stress, yet values remained within physiological limits. Smartwatch monitoring confirmed stable cardiovascular responses.

Conclusions: The multidisciplinary approach—combining rigorous clinical protocols, biomolecular monitoring, and technical training—successfully ensured worker safety and allowed for the early detection of latent pathologies. This project serves as a model of excellence for future hyperbaric civil engineering works in Italy.

EUBS2026-O.04

Psychotropic Medication Use in Divers: Prevalence, Clinical and Psychological Implications

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Background and Aims: The use of psychotropic medications among scuba divers is an emerging issue in diving medicine, raising concerns regarding safety, fitness-to-dive assessment, and psychological vulnerability. While mental health conditions are increasingly recognized in the general population, their implications in underwater environments remain under-explored. This study aims to investigate the prevalence of psychotropic drug use among divers and to discuss related clinical and psychological considerations.

Methods: An international survey targeting certified divers was conducted in two phases (October-November 2025 and February-April 2026), with a planned extension to further expand the dataset. The questionnaire collected data on demographic characteristics, psychiatric history, psychotropic medication use, and medical consultation prior to diving. It consisted of 16 items covering demographics, diving profile, mental health history, and psychotropic medication use. Data were pooled and analyzed descriptively. In parallel, a qualitative psychological framework was applied to explore individual vulnerability, anxiety management, and subjective underwater experiences.

Results: Final findings (n=1070; mean age 55) show that 31% of respondents reported lifetime use of psychotropic medications, with 16% currently under treatment. Additionally, 24% reported a lifetime psychiatric diagnosis. Notably, among those taking psychotropic medications, only 63% sought medical advice regarding fitness to dive, revealing a clinically relevant gap in fitness-to-dive assessment. Psychological analysis suggests that anxiety, panic vulnerability, and individual life history may significantly influence both diving experience and risk perception.

Conclusions: Psychotropic medication use among divers is common and requires careful, individualized assessment. Fitness-to-dive decisions should not rely solely on diagnosis or medication class but must consider clinical stability, treatment response, and psychological factors. A multidisciplinary approach involving diving physicians and mental health professionals is essential. Enhancing awareness, encouraging disclosure, and integrating psychological evaluation may improve safety and support a more informed approach to diving participation.

EUBS2026-O.05

Frequency and Magnitude of Myopic Shift in Hyperbaric Oxygen Treatment: A Systematic Review.

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Background and Aims: Myopic shift (MS) is a common and reversible side effect of hyperbaric oxygen treatment (HBOT) due to refractive changes in the lens. It seems to increase with longer duration of HBOT and to vary between hyperbaric chamber types and breathing systems. Clinically significant myopic changes may affect daily life, work and car-driving. This review aimed to assess the frequency and magnitude of myopic shift reported after HBOT.

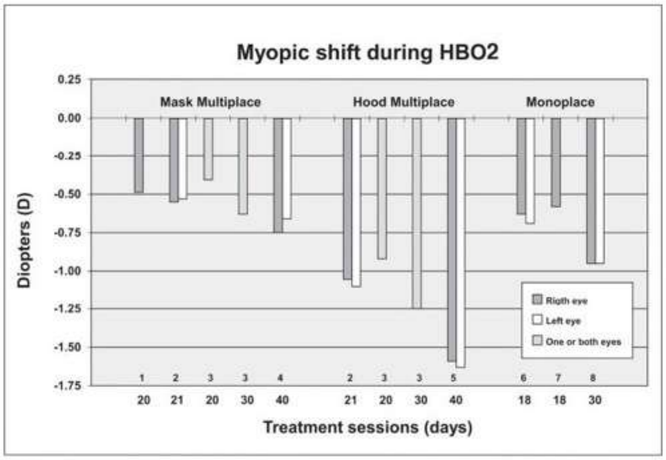
Methods: Medical databases were systematically searched for original studies on myopic shift after HBOT. Publications should be full-text articles in English, specify details on oxygen administration, pressure and number of treatments, using conventional techniques to measure refraction. Studies with exposure other than HBOT, patients with artificial lenses, and single-case reports were excluded.

Results:

Of 153 reports, eight studies with 263 patients were included. Treatment duration was 18-21, 30 or 40 sessions in either multiplace chambers using hoods or masks or in monoplace chambers.The frequency of a myopic shift ≥ 0.5 D (dioptres) after 18-21 sessions was 53-70% for multiplace-mask, 92% for multiplace-hood and 70-81% for monoplace chambers. After 40 sessions, it was 90% in multiplace-mask and 100% for multiplace-hood. The corresponding frequencies for a shift ≥1.0 D after 18-21 sessions using mask/ hood / monoplace were 15-21% / 68% / 30-38%, and after 30 sessions 39% / 82% / 52%.

The mean values of myopic shift ranged from 0.4 D after 20 treatments in multiplace-mask to 1.6 D after 40 sessions with multiplace-hood (Fig.1).

Figure 1. *Myopic shift after HBOT*



*Study-numbers: **1**. Fledelius 2002; **2**. Evanger 2004; **3**. Bennet 2019; **4**. Riedl 2019; **5**. Anderson & Farmer 1987; **6**. Evanger 2011; **7**. Evanger 2015; **8**. Evanger 2018.*

Conclusions: A myopic shift of 0.5 D or more occurs in 53-100% after standard-length HBOT, a pronounced myopic shift of 1.0 D or more is less frequent. Our findings indicate that the magnitude and incidence of myopic shift increase with the number of HBO2 sessions and in the order multiplace-mask < monoplace < multiplace-hood. Clinicians should be aware of this and implement the knowledge in pre-HBOT considerations and post-HBOT vision assessments and patient-guiding.

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Evanger K, et al. Undersea Hyperb Med. 2018; 45(4):395-402.

EUBS2026-O.06

Ten Hyperbaric Oxygen Sessions in Five Versus Ten Days for Acute Acoustic Trauma: Randomised Trial

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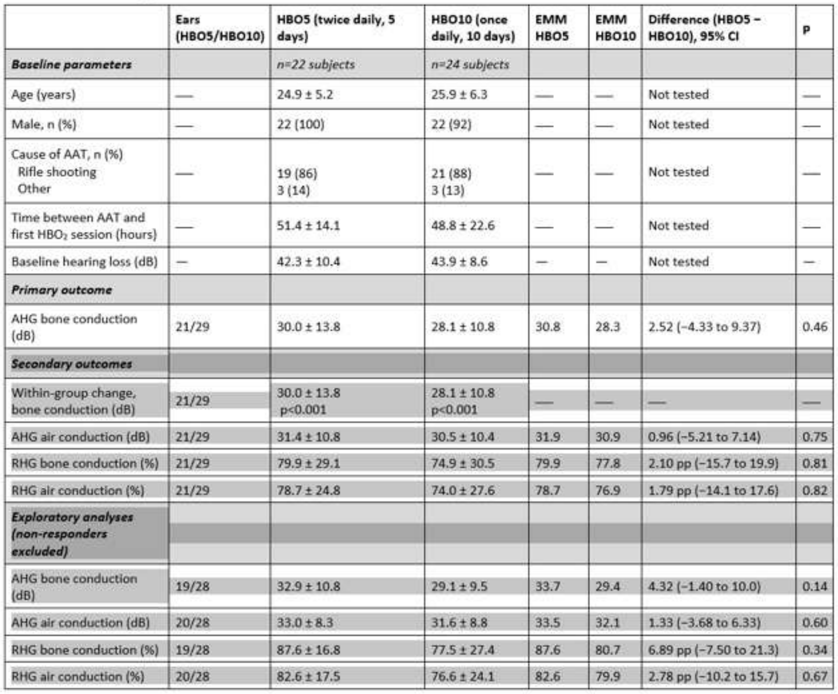
Background and Aims: Acute acoustic trauma (AAT) is a frequent cause of sensorineural hearing loss in military personnel. Combination therapy with hyperbaric oxygen therapy (HBO_2) and corticosteroids is standard care in severe AAT for the Dutch armed forces. We investigated whether a condensed regimen of HBO_2 twice daily for five days (HBO5) is superior to the standard regimen of once daily HBO_2 for ten days (HBO10).

Methods: This multicentre randomised superiority trial allocated adults with severe AAT 1:1 to HBO5 or HBO10. Both groups received ten HBO_2 sessions (240 kPa, 90 min, three 5-min air breaks). Primary endpoint was absolute hearing gain (AHG) one month after AAT on all affected frequencies (bone conduction values when available). The minimal clinically important difference was predefined at 8 decibel (dB). Due to slow inclusion, an interim futility analysis was performed when ≥50% of the planned sample (n=84) had completed follow-up. Because bilaterally affected patients contributed two ears, the primary outcome was analysed with a linear mixed model (random intercept for patient), with treatment group as fixed effect and baseline hearing loss as covariate.

Table 1. Baseline parameters and outcomes



	Ears (HBO5/HBO10)	HBO5 (twice daily, 5 days)	HBO10 (once daily, 10 days)	EMM HBO5	EMM HBO10	Difference (HBO5 – HBO10), 95% CI	P
Baseline parameters		*n=22 subjects*	*n=24 subjects*				
Age (years)	—	24.9 ± 5.2	25.9 ± 6.3	—	—	Not tested	—
Male, n (%)	—	22 (100)	22 (92)	—	—	Not tested	—
Cause of AAT, n (%) Rifle shooting Other	—	19 (86) 3 (14)	21 (88) 3 (13)	—	—	Not tested	—
Time between AAT and first HBO_2 session (hours)	—	51.4 ± 14.1	48.8 ± 22.6	—	—	Not tested	—
Baseline hearing loss (dB)	–	42.3 ± 10.4	43.9 ± 8.6	–	–	Not tested	–
Primary outcome							
AHG bone conduction (dB)	21/29	30.0 ± 13.8	28.1 ± 10.8	30.8	28.3	2.52 (−4.33 to 9.37)	0.46
Secondary outcomes							
Within-group change, bone conduction (dB)	21/29	30.0 ± 13.8 p<0.001	28.1 ± 10.8 p<0.001	—	—	—	—
AHG air conduction (dB)	21/29	31.4 ± 10.8	30.5 ± 10.4	31.9	30.9	0.96 (−5.21 to 7.14)	0.75
RHG bone conduction (%)	21/29	79.9 ± 29.1	74.9 ± 30.5	79.9	77.8	2.10 pp (−15.7 to 19.9)	0.81
RHG air conduction (%)	21/29	78.7 ± 24.8	74.0 ± 27.6	78.7	76.9	1.79 pp (−14.1 to 17.6)	0.82
Exploratory analyses (non-responders excluded)							
AHG bone conduction (dB)	19/28	32.9 ± 10.8	29.1 ± 9.5	33.7	29.4	4.32 (−1.40 to 10.0)	0.14
AHG air conduction (dB)	20/28	33.0 ± 8.3	31.6 ± 8.8	33.5	32.1	1.33 (−3.68 to 6.33)	0.60
RHG bone conduction (%)	19/28	87.6 ± 16.8	77.5 ± 27.4	87.6	80.7	6.89 pp (−7.50 to 21.3)	0.34
RHG air conduction (%)	20/28	82.6 ± 17.5	76.6 ± 24.1	82.6	79.9	2.78 pp (−10.2 to 15.7)	0.67

HBO_2: Hyperbaric Oxygen Therapy; AAT: Acute Acoustic Trauma; AHG: Absolute Hearing Gain; RHG: Relative Hearing Gain; EMM: Estimated Marginal Mean; dB: decibel; CI: Confidence Interval; SD: Standard Deviation; pp: percentage points. Values are mean ± SD unless otherwise indicated. —: not applicable.

Results:

At interim, 45 of 46 subjects had complete follow-up data, yielding 50 affected ears (HBO5: n=21, HBO10: n=29). Bayesian predictive power that continuation to the planned sample size would yield a significant difference was 0.04. Combined with persistently slow recruitment, the trial was terminated for futility. Mean AHG on affected frequencies (bone conduction) was 30.0 dB (SD 13.8) in HBO5 and 28.1 dB (SD 10.8) in HBO10 (adjusted estimated marginal mean 30.8 vs 28.3; difference 2.52 dB; 95% CI −4.33 to 9.37; p=0.46). HBO_2-related adverse events (mild barotrauma, transient visual disturbance, fatigue) were infrequent; one serious adverse event (mental stress) occurred in the HBO5 group. 84% of subjects preferred treatment in five over treatment in ten days.

Conclusions: In this trial, HBO5 did not demonstrate superiority over HBO10. Although the CI makes a clinically meaningful disadvantage of HBO5 less likely, study-setup, early termination and limited sample size preclude formal non-inferiority conclusions. A condensed five-day regimen may nonetheless be a clinically attractive alternative.

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EUBS2026-O.07

Exploring the Efficacy of Hyperbaric Oxygen Therapy for Severe Motor Deficit Following Spine Surgery

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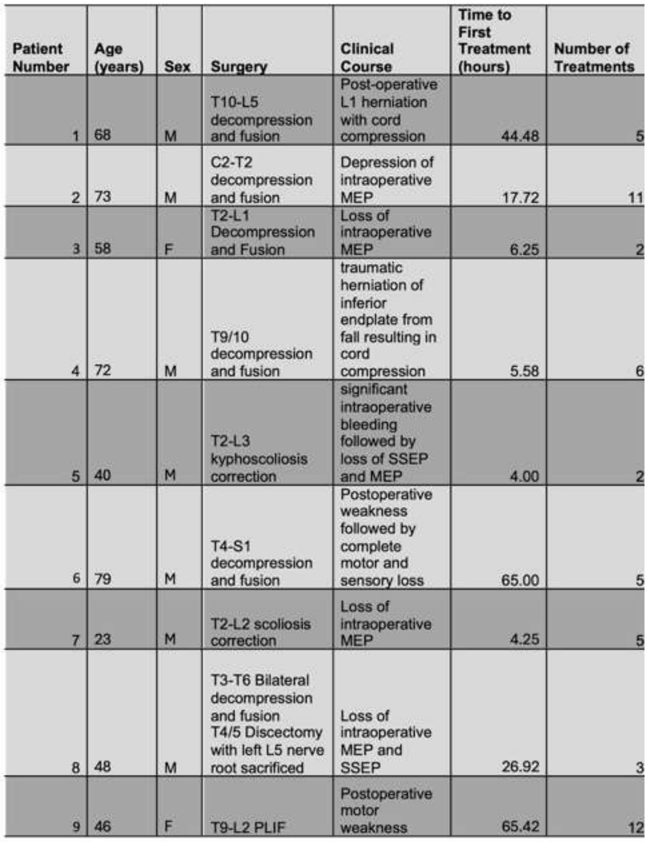
Background and Aims: Severe motor deficit following spine surgery is a rare but catastrophic complication, with an incidence between 0.75-9%.[1-3] The risk is elevated in extensive multilevel procedures, deformity corrections, and surgeries involving vascular manipulation or prolonged operative times. Adjunctive therapies, including blood pressure augmentation, dexamethasone, and Riluzole. Evidence supporting the use of hyperbaric oxygen therapy (HBOT) in this context remains scarce, and no standardized treatment protocol currently exists.

Methods: REB approval was obtained. A retrospective chart review was conducted to identify patients with severe motor deficit following spine surgery and subsequently underwent HBOT at Toronto General Hospital between January 2018 and December 2025. Demographic, treatment, and outcomes data were extracted. Cumulative treatment time is described in atmosphere-minutes (ATM-min) and is calculated as the product of treatment pressure (in ATA) and time (in minutes) for the entire treatment course. Outcomes were categorized into three groups based on the motor score improvement between their pre-HBOT and post-HBOT scores. A score of zero was classified as no improvement, 1-10 classified as moderate improvement, and >=10 classified as major improvement.

Results: During the study period, nine patients were treated. Seven (78%) were male with a mean age of 56.3 (±18.5). All patients underwent blood pressure augmentation, four received dexamethasone, and two received Riluzole. Median time to treatment was 17.2 hours (range:4-65.42hours) and most patients underwent initial treatment at 2.8 ATA for 125 minutes followed by latter treatments at 2-2.4 ATA for 90 minutes. The median number of treatments was 5 (range:2-12) with a mean cumulative treatment time of 1429 ATM-min. Three patients had no improvement, three had moderate improvement, and three had major improvement. Major improvement seemed to be associated with longer cumulative treatment and shorter time from surgery to treatment. No short- or long-term sequelae of HBOT were reported.



Patient Number	Age (years)	Sex	Surgery	Clinical Course	Time to First Treatment (hours)	Number of Treatments
1	68	M	T10-L5 decompression and fusion	Post-operative L1 herniation with cord compression	44.48	5
2	73	M	C2-T2 decompression and fusion	Depression of intraoperative MEP	17.72	11
3	58	F	T2-L1 Decompression and Fusion	Loss of intraoperative MEP	6.25	2
4	72	M	T9/10 decompression and fusion	traumatic herniation of inferior endplate from fall resulting in cord compression	5.58	6
5	40	M	T2-L3 kyphoscoliosis correction	significant intraoperative bleeding followed by loss of SSEP and MEP	4.00	2
6	79	M	T4-S1 decompression and fusion	Postoperative weakness followed by complete motor and sensory loss	65.00	5
7	23	M	T2-L2 scoliosis correction	Loss of intraoperative MEP	4.25	5
8	48	M	T3-T6 Bilateral decompression and fusion T4/5 Discectomy with left L5 nerve root sacrificed	Loss of intraoperative MEP and SSEP	26.92	3
9	46	F	T9-L2 PLIF	Postoperative motor weakness	65.42	12

MAP-mean arterial pressure, PLIF-posterior lumbar interbody fusion, M-male, F-Female, MEP-motor evoked potential, SSEP-Somatosensory Evoked Potentials

Conclusions: This case series demonstrates that HBOT, as an adjunctive therapy for patient with post-spine surgery severe motor deficit, seems to provide major benefit for a proportion of treated patients. Further research is needed to characterize patient and surgical factors that are predictive of a response to HBOT.

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EUBS2026-O.08

Hyperbaric Oxygen Therapy for Post-COVID-19: One-Year Outcomes of a Prospective Cohort Study

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Background and Aims: Post-COVID-19 condition (PC-19) affects tens of millions of patients worldwide, with cognitive dysfunction and fatigue as predominant symptoms. Hyperbaric oxygen therapy (HBOT) has shown promising short-term results in neurocognitive recovery, but long-term follow-data remain scarce. This study presents one-year outcomes of HBOT in PC-19 patients.

Methods: A prospective, single-center cohort study was conducted at a dedicated hyperbaric center in the Netherlands. Patients ≥18 years with a confirmed PC-19 diagnosis who completed a minimum of 30 HBOT sessions (2.4 ATA, 105 minutes per session containing four 20-minute intervals with 100% oxygen) were eligible. Primary outcome was the Modified Fatigue Impact Scale (MFIS), including its cognitive subscore (MFIS-c). Secondary outcomes included the EQ-5D-3L visual analogue scale (EQ-5D VAS), EQ-5D index, and job participation in hours per week. Assessments were performed at baseline, end of treatment, three months, and one year post-treatment.

Results: Of 89 eligible patients, 71 were included (76,6% female; mean age 47 years; median disease duration 16 months). The median MFIS total score improved significantly from 66 at baseline to 48.5 one year post-treatment ($p<0.001$). The MFIS-c improved from 32 to 21.5 ($p<0.001$). The EQ-5D VAS improved from a mean of 37.1 to 61.1 ($p<0.001$). Overall, 68.3% of patients demonstrated clinically relevant improvement, while worsening was observed in only 3.3%. In the subgroup able to return to work at one year, median weekly working hours increased from 0 to 25 hours, compared to 35 hours prior to COVID-19 infection.

Conclusions: HBOT demonstrates sustained, clinically relevant improvements in cognitive symptoms and self-related health in PC-19 one year after treatment. Nearly half of patients resumed meaningful work participation. The wide variability in treatment respons underscores the need for further subgroup analysis. Furthermore, individualized post-HBOT rehabilitation, ideally combining graded physical rehabilitation and psychological support, appears to be crucial for sustaining the achieved improvements.

EUBS2026-O.09

NHBOT: A Retrieval-Augmented AI Knowledge Assistant for Hyperbaric Medicine

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Background and Aims: Hyperbaric oxygen therapy (HBOT) remains a highly specialised field with limited exposure during undergraduate and postgraduate medical education. Consequently, many clinicians have limited familiarity with established indications, absolute and relative contraindications, protocol variability, and the evolving evidence base surrounding HBOT. Simultaneously, the field is receiving increasing attention across multiple medical specialties, with ongoing clinical research contributing to a rapidly expanding body of evidence. This creates a growing need for accessible, transparent, and evidence-informed educational resources. This study presents NHBOT, a specialist artificial intelligence (AI) knowledge assistant developed to support evidence-informed learning in hyperbaric medicine.

Methods: NHBOT uses a Retrieval-Augmented Generation (RAG) architecture built upon a curated HBOT knowledge library composed of peer-reviewed research papers, clinical studies, and scientific literature. The underlying language model facilitates natural language interaction, semantic literature retrieval, and generation of evidence-grounded conversational responses.
To improve retrieval quality and preserve scientific context, the knowledge library is structured using semantic chunking techniques that divide research content into context-aware units while maintaining citation traceability through deterministic citation mapping. The platform was designed with a strong emphasis on governance, prioritising transparency, evidence traceability, and responsible use within a medical information environment. Comprehensive evaluation and autonomous testing pipelines were developed to continuously assess retrieval accuracy, citation quality, factual consistency, and hallucination risk.

Results: NHBOT demonstrated traceable evidence retrieval, with generated responses directly linked to supporting scientific literature. The retrieval-augmented architecture reduced reliance on unconstrained language model generation while improving transparency of evidence sourcing. Semantic chunking improved contextual preservation across complex hyperbaric literature, while deterministic citation mapping enabled direct verification of generated claims by end users. Continuous testing pipelines monitored hallucination risk, retrieval consistency, and citation reliability throughout iterative system refinement.

Conclusions: NHBOT demonstrates the feasibility of a specialist evidence-grounded AI assistant designed specifically for hyperbaric medicine. By combining curated scientific knowledge libraries with retrieval-augmented AI methodologies, the platform provides transparent access to evidence-based HBOT information while reducing the risk of unsupported AI-generated medical content. NHBOT is intended as a collaborative educational and evidence-support tool rather than a replacement for clinical expertise or specialist consultation.

EUBS2026-O.10

When the Chain Breaks: The Limits of Investigation in a CCR Diving Fatality

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Case description: A 34-year-old male police diver died during a solo CCR training dive in a freshwater dam. The body was recovered the following day on the bottom at a depth of 25 mfw in a supine position. A spool line was found near the left hand, while a surface marker buoy (SMB) remained unused in the pocket. Autopsy revealed pronounced pulmonary barotrauma with cerebral arterial gas embolism (CAGE), accompanied by numerous intravascular gas bubbles, including within the coronary arteries, and pneumothorax. Bilateral perforations of the tympanic membranes were present. Additional findings included oedema of the aditus laryngis and haemorrhage of the tongue with protrusion into the mouthpiece, without bite marks. Dive profile analysis demonstrated a rapid ascent from approximately 25 mfw to 13 mfw, followed by a subsequent fast passive descent. Technical examination of the CCR unit did not reveal any evident malfunction.

Conclusions: The investigation of diving fatalities represents a complex multidisciplinary analytical process, especially in unwitnessed scenarios. Integration of post-mortem findings with dive profile data, technical equipment evaluation, and scene-related information, together with antemortem data such as medical history, diving experience, and environmental conditions, allows for the formulation of the most probable sequence of events, consistent with the principles of Chain of Events Analysis (CEA). In this case, the combined findings are consistent with an acute disruptive event at depth, resulting in rapid uncontrolled ascent, pulmonary barotrauma, and subsequent incapacitation with secondary descent. However, the precise initiating trigger remains undetermined. Even with complete forensic and technical analysis, the initiating event in CCR fatalities may remain unknowable; nevertheless, it is possible to define the most probable mechanism and identify critical risk pathways. This case underscores both the interpretative value and the inherent limitations of current forensic and technical approaches and highlights the importance of structured multidisciplinary analysis in the evaluation of fatal CCR diving incidents.

EUBS2026-O.11

Reducing DCI Overdiagnosis Using a Pattern Mismatch Decision Score

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Background and Aims: Diving-related clinical assessment is frequently affected by diagnostic uncertainty, particularly in suspected decompression illness (DCI), where symptom-based diagnosis may lead to overdiagnosis or misclassification. A recurring challenge is the discrepancy between dive profile, exposure risk and clinical presentation. We introduce the Pattern Mismatch (PM) Score, a structured clinical tool designed to identify inconsistencies between expected pathophysiology and observed symptoms, supporting differential diagnosis and reducing inappropriate recompression.

Methods: The PM Score was developed within a real-world clinical dataset derived from field experience in operational diving medicine, including recreational, technical and occupational divers. The score is based on a structured multi-domain assessment including: (1) symptom distribution and morphology, (2) symptom quality, (3) presence or absence of systemic involvement and (4) identification of alternative triggers or mechanisms. Each domain is scored (0–2), generating a cumulative score ranging from 0 to 6. A threshold ≥4 indicates a high probability of pattern mismatch and low likelihood of DCI, prompting alternative diagnostic pathways. Cases were retrospectively analysed to identify concordance or mismatch between exposure and clinical presentation and refined through expert review.

Results: Application of the PM Score identified cases in which clinical presentation was inconsistent with DCI pathophysiology. These “pattern mismatch” cases frequently involved alternative diagnoses, including musculoskeletal strain, radiculopathy, dermatological reactions and post-exertional symptoms. In a representative case, a diver developed cutaneous symptoms after a shallow, non-decompression dive followed by significant physical exertion; the PM Score was 6/6 (maximum mismatch), indicating high mismatch and low probability of DCI, and follow-up confirmed a non-DCI diagnosis without recompression treatment. Conversely, concordant exposure–symptom patterns showed a higher likelihood of true DCI. The PM Score improved diagnostic clarity, supported risk stratification and enhanced decision-making in clinical settings.

Conclusions: The Pattern Mismatch Score represents a practical and clinically grounded approach to improving diagnostic accuracy in diving medicine. By integrating exposure data with symptom analysis, it reduces cognitive bias, supports severity-oriented reasoning and promotes appropriate use of hyperbaric treatment. This framework may contribute to standardising clinical reasoning in diving-related incidents and has potential for integration into decision-support systems.

EUBS2026-O.12

In-Water Recompression: An International Survey Assessing Knowledge and Real-World Application

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Background and Aims: In-water recompression (IWR) is occasionally considered by divers for rapid treatment of decompression illness (DCI), but it remains controversial due to risks and logistical challenges. Experts in the field have proposed specific frameworks for its application, and training programs are now offered by official organizations. Its use and training among recreational divers are undocumented. This survey explores divers' perceptions, knowledge, training, and use of IWR.

Methods: An anonymous international multilingual online survey was distributed via social media and specialized diving press to experienced scuba divers (minimum Advanced Nitrox certification). Demographics, diving experience, and specific training were collected, along with perceptions of IWR and its use in real-life situations.

Results: A total of 1,223 responses were collected (1,085 male, 138 female; mean age 52±13 years). Of these divers, 219 (18%) divers believed IWR could routinely replace conventional (chamber delivered) recompression therapy and achieve similar results. While 1,155 (94%) would arrange evacuation after initial IWR if symptoms persisted, only 730 (60%) would do so if symptoms resolved. 1,115 (91%) considered specific training necessary. Preferred breathing gases were pure oxygen (51%), nitrox (37%), air (2%); the rest considered gas type secondary to recompression. Out of 505 (41%) divers that included IWR in emergency plans, only 95/505 (19%) had formal training. IWR had been performed by 139/505 (28%) as the injured- or the safety-diver, with 19 reporting complications during the procedure, including 5 seizures (1 fatal) and 6 other signs of oxygen toxicity. Four cases involved technical failure or insufficient gas supply. Among those who had never considered IWR, 555/718 (77%) respondents reported that they would reconsider their position if they received appropriate training.

Conclusions: Though HBOT remains the gold standard for the treatment of DCI, experienced divers widely consider IWR in their emergency procedures. Despite this, few have received formal training, potentially leading to inappropriate patient selection and unsafe protocols, with increased risk of complications or clinical deterioration. Standardized procedures and clearer indications are needed. Targeted, case-based technical training and access to medical consultation, ideally with physicians experienced in IWR, including via telemedicine, may improve safety and decision-making.

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EUBS2026-O.13

CoDe1: How Are Gases Differentially Managed in the Brains of BHD and Scuba?

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Background and Aims: The Co.De.1 project consists of a series of experiments accomplished in open seawater over a two-year period 2023-2025.

A group of divers were studied to verify how diving at different depth, breath holding or not, interact with the lungs and brain and their gas exchange capacity, and specific biomarkers of local (alveolar-epithelial) and systemic inflammation.

This proposal aims to investigate how underwater exposures during BHD or SCUBA diving: (1) interact with the lungs and their gas exchange capacity, causing lung parenchymal and arterial partial pressure of oxygen alterations; (2) result in different predispositions to develop decompression illness (DCI); (3) modify gas distribution in arterial blood and in the brain.

Methods: The project was approved by the institutional ethics committee to be carried out in open seawater. It includes 10 healthy and trained BH divers, diving at 15 msw (49.2 fsw) after warm-up and baseline sampling. Arterial blood samples are collected: i) immediately before the dive, after the last breath; ii) at 15 msw; iii) at the surface, immediately before the break of apnea with the face still submerged. 10 healthy and trained SCUBA divers breathing compressed air, after baseline sampling, will reach 15 msw to pedal on an underwater bicycle. Arterial samples are collected: i) at the surface; ii) at the bottom, before pedaling; iii) at the bottom, after pedaling; iv) at the surface. Measurements include arterial pH, O_2 and CO_2 partial pressures, lactate, brain neurotransmitters biomarkers (glutamate, GABA, dopamine and serotonin), BDNF, GFAP, pro-inflammatory microparticles, neutrophil activation, and biomarkers of alveolar epithelial; oxidative stress (i.e. ROS, lipid peroxidation) and systemic inflammation (i.e. IL-6, IL-10, TNF-a; VICAM, Syndecam, Heparan Sulfate, SP-D; and sRAGE). Microbubbles formation,NIRS and Chest ultrasound will be performed.

Results:

Conclusions: We conclude that responses to pressure rapidly establish inflammatory conditions in divers; this imbalance requires specific monitoring during diving activities and more deeper experiments with different gases are requested to mitigate the risk.

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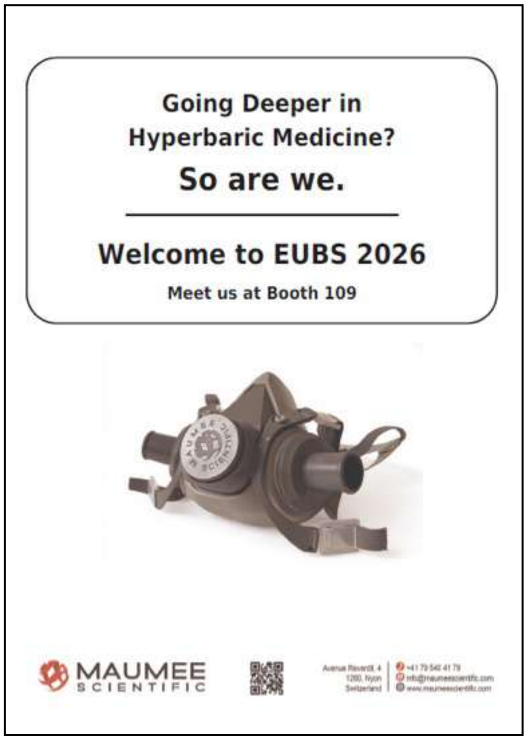

EUBS2026-O.14

Perceived Compliance: A Prospective Structured Questionnaire Analysis of Procedural Risk Factors in Diving Decompression Sickness

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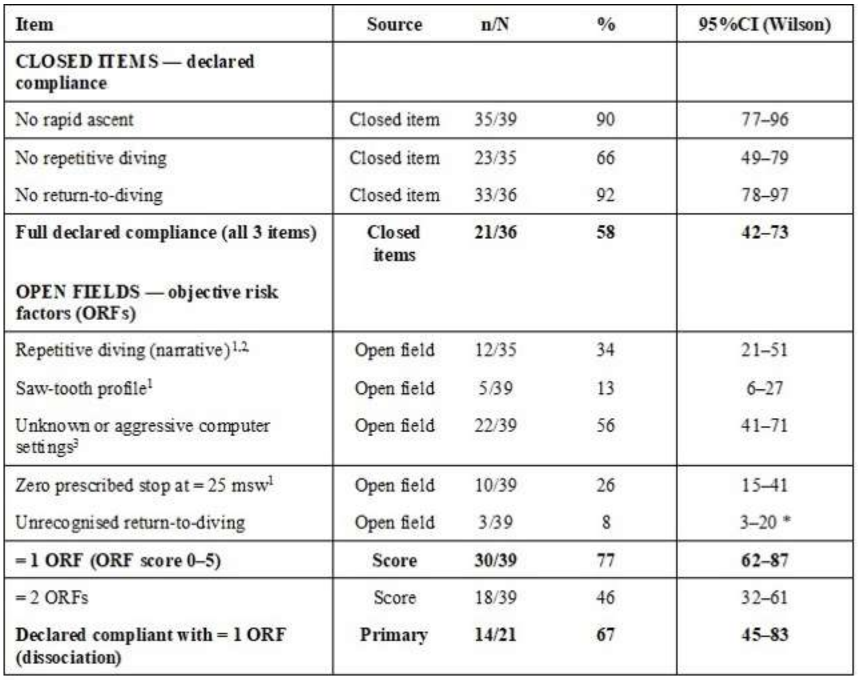
Background and Aims: Most recreational divers with decompression sickness (DCS) report full procedural compliance. A naval hyperbaric centre registry records 86% declared compliance in recreational open-circuit DCS patients. This study examined whether this reflects genuine safety or perceived conformity, using a structured questionnaire to capture risk factors binary self-report cannot detect.

Methods:

Prospective bi-source study. Source 1: 2025 registry (n = 205; reference population: recreational open-circuit DCS, n = 73). Source 2: structured questionnaire (six domains: dive profile, decompression stops, computer settings, dive history, contextual factors, gas) with closed yes/no items and open narrative fields, offered systematically on admission; 39 patients completed it (response rate 53%). Objective risk factors (ORFs) — repetitive diving, saw-tooth profile, unknown or aggressive computer settings, zero prescribed stop at ≥ 25 msw, unrecognised return-to-diving (score 0–5) — were derived from open fields per published literature.[1,2,3]



Item	Source	n/N	%	95%CI (Wilson)
CLOSED ITEMS — declared compliance				
No rapid ascent	Closed item	35/39	90	77–96
No repetitive diving	Closed item	23/35	66	49–79
No return-to-diving	Closed item	33/36	92	78–97
Full declared compliance (all 3 items)	**Closed items**	**21/36**	**58**	**42–73**
OPEN FIELDS — objective risk factors (ORFs)				
Repetitive diving (narrative)[1,2]	Open field	12/35	34	21–51
Saw-tooth profile[1]	Open field	5/39	13	6–27
Unknown or aggressive computer settings[3]	Open field	22/39	56	41–71
Zero prescribed stop at = 25 msw[1]	Open field	10/39	26	15–41
Unrecognised return-to-diving	Open field	3/39	8	3–20 *
= 1 ORF (ORF score 0–5)	**Score**	**30/39**	**77**	**62–87**
= 2 ORFs	Score	18/39	46	32–61
Declared compliant with = 1 ORF (dissociation)	**Primary**	**14/21**	**67**	**45–83**

Appendix : Closed items (declared compliance) and open-field objective risk factors (ORFs) in the questionnaire cohort (n = 39).

Results: Both cohorts were comparable on six of seven pre-specified variables (all p > 0.20). On closed items, 21/36 patients (58%) declared full procedural compliance. Open fields identified: unknown or aggressive computer settings in 56% (95%CI 41–71), repetitive diving in 34% (21–51), zero prescribed stop at ≥ 25 msw in 26% (15–41), and saw-tooth profile in 13% (6–27). Among the 21 fully compliant patients, 14 (67%, 95%CI 45–83) had at least one ORF.

Conclusions: Declared compliance does not reflect objective procedural risk. Two-thirds of self-declared compliant patients had identifiable ORFs, predominantly unknown or aggressive computer settings. Systematic dive computer profile extraction at initial DCS assessment and training on decompression algorithm parameterisation are two underexploited prevention levers.

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EUBS2026-O.15

Delayed-Onset Transient Anisocoria After Decompression Sickness in a Scuba-Diver: A Case Report and Pathophysiological Hypothesis

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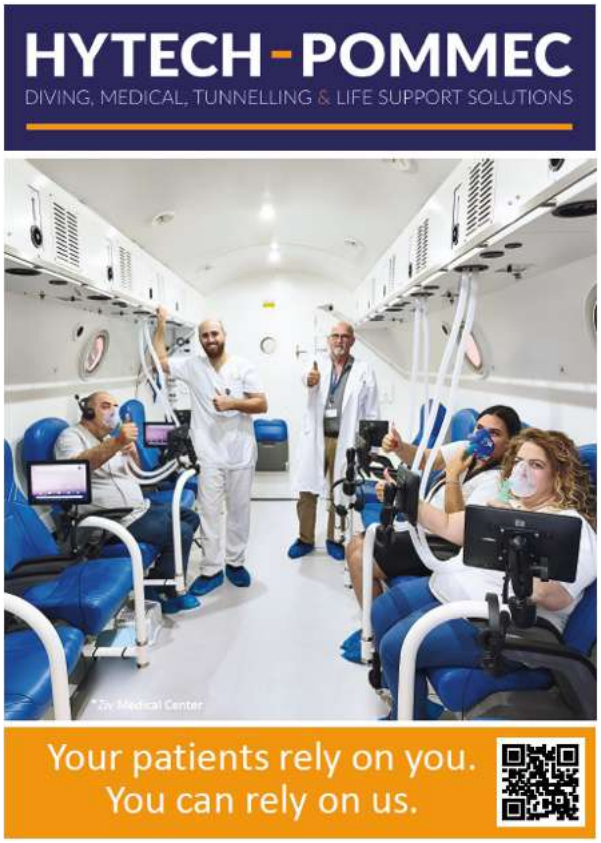
Case description: A 35-year-old male technical diver developed bilateral shoulder pain, pain in the right knee, bilateral arm paralysis, and cutis marmorata 5-10 minutes after surfacing from a single rebreather dive with a square profile to max 49 meters of seawater (msw) with a bottom time (BT) of 33 minutes and total dive time (TDT) of 72 minutes. He was using the internal decompression algorithm of his AP CCR (closed-circuit rebreather) and performed all required deco-stops. He was immediately treated with normobaric oxygen by the boat crew and was evacuated 20-30 minutes later to a hospital with hyperbaric chamber by helicopter. The paralysis and pain started to reduce during the helicopter flight. On arriving at the hospital, he had normal motor function of the upper limbs but a continuing pain over the entire length of both arms that had only mildly reduced. A recompression treatment with USN TT6 table led to near-complete resolution of symptoms. The patient started to develop bilateral lymphoedema localized to the upper arms a few hours after the first hyperbaric treatment. After a second recompression treatment (2.5 ATA, 70’ O2), 18 hours after the original DCS without other neurological signs, he developed a sudden, overt anisocoria. There was a right sided mydriasis and slightly reduced indirect light reflex. An urgent head CT was normal. He was referred to the nearby university hospital for an urgent consultation. Neurologic and ophthalmologic evaluation suggested transient ischemia of the Edinger–Westphal nucleus. All subsequent investigations were normal (MRI of the brain, transthoracic echocardiography, and carotid duplex studies). The anisocoria resolved spontaneously within 24 hours. Later, a transthoracic echocardiography with contrast was performed, showing a PFO with grade 2 patency.

Conclusions: The appearance of anisocoria after a first therapeutic recompression represents an interesting diagnostic and pathophysiologic ‘riddle’. It was confirmed that the anisocoria was not present before the first recompression. Although other hypotheses may be formulated, in this case a high cervical spine DCS with transient autonomic dysreflexia is advanced as the most plausible pathophysiology.



EUBS2026-O.16

Evaluation of External Ventricular Drain Performance Under Hyperbaric Conditions: A Bench Study

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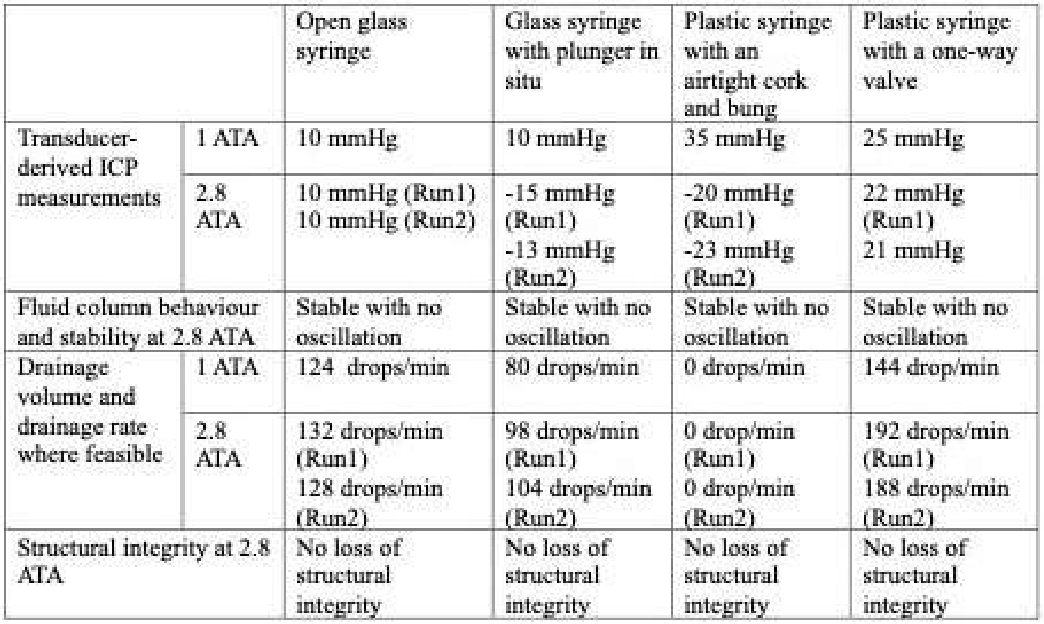
Background and Aims: External ventricular drains (EVDs) are widely used for intracranial pressure (ICP) monitoring and cerebrospinal fluid (CSF) diversion in neurocritical care. Hyperbaric oxygen treatment (HBOT) exposes medical devices to increased ambient pressure; however, limited data exists regarding EVD performance and reliability under hyperbaric conditions.

Methods: A bench study was conducted to evaluate EVD performance under hyperbaric conditions. A rigid, non-compressible saline-filled column was used to assess pressure measurement stability independent of compliance effects. Additional compliance-based syringe models were explored to assess the feasibility of evaluating unclamped drainage behaviour. A commercially available EVD system (CODMAN EDS 3; Codman & Shurtleff, a Johnson & Johnson company, Raynham, MA, USA) was exposed to stepwise ambient pressures from 101 to 283 kPa (1.0–2.8 atmospheres absolute (ATA)) in a multiplace hyperbaric chamber. Pressure measurements, drainage behaviour, fluid column stability, and system integrity were assessed.

Results:

The CODMAN EDS 3 EVD system maintained structural integrity across tested pressure levels. While pressure measurements were stable in the rigid open glass syringe model, the closed compliance-based models demonstrated pressure variability during chamber pressurisation, including when closed to fluid drainage. Unclamped testing using these models demonstrated inconsistent fluid dynamics, precluding reliable assessment of fluid drainage behaviour under hyperbaric conditions.



		Open glass syringe	Glass syringe with plunger in situ	Plastic syringe with an airtight cork and bung	Plastic syringe with a one-way valve
Transducer-derived ICP measurements	1 ATA	10 mmHg	10 mmHg	35 mmHg	25 mmHg
	2.8 ATA	10 mmHg (Run1) 10 mmHg (Run2)	-15 mmHg (Run1) -13 mmHg (Run2)	-20 mmHg (Run1) -23 mmHg (Run2)	22 mmHg (Run1) 21 mmHg
Fluid column behaviour and stability at 2.8 ATA		Stable with no oscillation	Stable with no oscillation	Stable with no oscillation	Stable with no oscillation
Drainage volume and drainage rate where feasible	1 ATA	124 drops/min	80 drops/min	0 drops/min	144 drop/min
	2.8 ATA	132 drops/min (Run1) 128 drops/min (Run2)	98 drops/min (Run1) 104 drops/min (Run2)	0 drop/min (Run1) 0 drop/min (Run2)	192 drops/min (Run1) 188 drops/min (Run2)
Structural integrity at 2.8 ATA		No loss of structural integrity	No loss of structural integrity	No loss of structural integrity	No loss of structural integrity

Conclusions: The CODMAN EDS 3 EVD system remained structurally intact during hyperbaric exposure; however, pressure measurements varied in closed models, including when closed to fluid drainage. ICP measurements obtained during HBOT should be interpreted with caution due to potential pressure-related artefacts. Reliable continuous assessment of fluid pressure drainage behaviour remains limited by current bench model constraints. Further research incorporating advanced brain compliance simulation models and carefully designed in-vivo observational studies is required to better characterise EVD behaviour under hyperbaric conditions and to ensure safe clinical use and accurate interpretation of ICP measurements in the hyperbaric environment.

EUBS2026-O.17

From CO to NSTI: Eleven-Year Trends in Ventilated ICU-HBOT Patients

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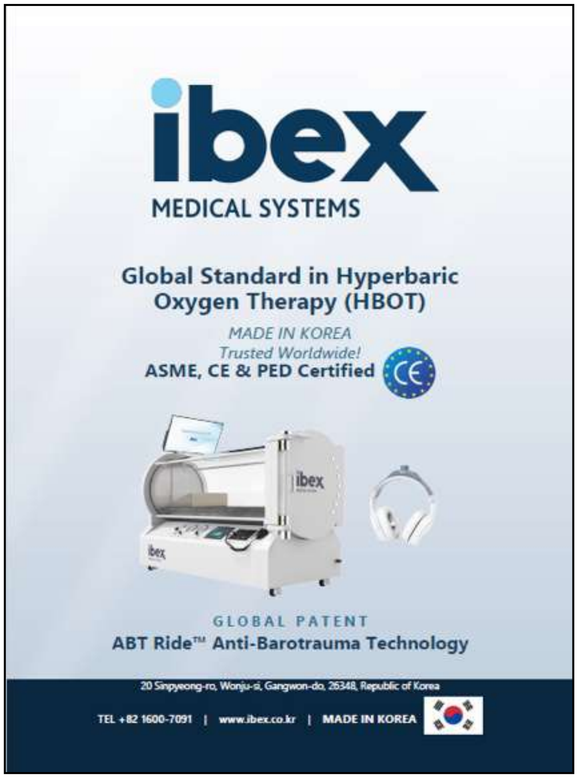
Background and Aims: Mechanically ventilated ICU patients receiving HBOT are uncommon but resource-intensive. Although acute HBOT indications have remained broadly stable, the case mix managed by 24/7 hyperbaric services may change over time, affecting staffing, chamber access and ICU-level preparedness. We assessed 11-year hospitalisation and treatment trends at an academic hyperbaric centre.

Methods: This secondary temporal analysis used a retrospective single-centre cohort of mechanically ventilated ICU patients treated with HBOT in 2013–2023. Diagnoses were grouped as carbon monoxide (CO) poisoning, clostridial myonecrosis/gas gangrene, other necrotising soft tissue infection (NSTI), or other. Annual patient and session volumes, nocturnal sessions, vasopressor use, continuous veno-venous haemodiafiltration (CVVHDF), and in-hospital mortality were assessed. Calendar-year trends were examined with exploratory logistic regression; prespecified era comparisons used χ^2 or Fisher's exact tests.

Results: The centre treated 6,396 HBOT patients and delivered 103,050 HBOT sessions. The ventilated ICU-HBOT cohort comprised 176 patients undergoing 1,381 sessions, including 781 nocturnal sessions. Thus, ventilated ICU-HBOT represented 2.8% of all treated patients/episodes, 1.3% of all HBOT sessions, and 8.6% of 2,038 hospitalised HBOT patients. Annual volume ranged from 10 to 22 patients and from 66 to 190 sessions, without a simple linear increase. Case-mix changed substantially across eras: CO decreased from 34.3% to 12.3%, clostridial myonecrosis/gas gangrene from 35.7% to 15.8%, whereas other NSTI increased from 25.7% to 57.9% (p=0.00005). In year-by-year models, the odds decreased for CO (OR 0.85/year, 95% CI 0.76–0.95; p=0.0038) and clostridial myonecrosis/gas gangrene (OR 0.85/year, 95% CI 0.76–0.96; p=0.0090), but increased for NSTI (OR 1.23/year, 95% CI 1.11–1.36; p<0.0001). Vasopressor use differed across eras (72.9%, 63.3%, 89.5%; p=0.0059).

Conclusions: Over 11 years, this ventilated ICU-HBOT population shifted from CO and clostridial infection toward other NSTI, with a higher proportion of vasopressor-supported critical illness in the later era. Substantial nocturnal service demand persisted throughout the study period.



EUBS2026-O.18

WHO-Style Safety Checklist for Intensive Care Hyperbaric Transport and Management

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Background and Aims: Intra-hospital transport of intubated and mechanically ventilated intensive care patients is associated with risk, regardless of destination [1]. For patients undergoing hyperbaric oxygen therapy (HBOT), this generic transport risk is combined with additional HBOT-specific hazards related to chamber-compatible equipment, pressure-related adaptations, fire safety, communication, and post-treatment reconnection. At Karolinska University Hospital, we have used a structured safety checklist for critically ill patients treated in the multiplace chamber for more than 15 years. Adherence to the "pre-transport" and "sign-out" sections have not been ideal, partly due to repetitions in the transport checklist, lack of time and a non-standard format, well known hurdles for adherence [2]. To optimize adherence and clarity with focus on safety for both staff an the patient, we recently adopted the WHO Surgical Safety Checklist structure [3], because it is well known, easy to use in team-based practice, and already familiar to staff already familiar to staff in perioperative medicine and intensive care.

Methods: We performed a multidisciplinary redesign project involving chamber personnel responsible for ICU-to-HBOT care, physicians and nurses. We reformatted our long-standing local HBOT checklist and workflow for transport into a WHO Surgical Safety Checklist–style structure with defined phases for team briefing, risk assessment, timeout before chamber start, monitoring during treatment, preparation for return transport, and handover after HBOT. The content was retained from established local practice but re-designed to improve clarity, recognizability, and usability across perioperative and intensive care teams.

Results:

Conclusions: This work addresses a checklist re-design rather than a new safety concept. Presenting HBOT safety checks in a familiar WHO-style format may be helpful both for centres introducing a checklist and for those wishing to reformat or standardize an existing local tool.

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EUBS2026-O.19

Survey of Hyperbaric Treatment Protocols in Use for Diving-Related and Iatrogenic Cerebral Gas Embolism

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Background and Aims: Hyperbaric oxygen (HBO) is the standard treatment for cerebral gas embolism (CGE). Published retrospective cohorts have typically reported the use of a single HBO session, whereas current guidelines recommend repeat HBO until no further improvement, analogous with decompression sickness practice. We surveyed hyperbaric units to determine which protocols are currently in use.

Methods: In 2025, hyperbaric units were invited to complete a questionnaire on HBO protocols for iatrogenic and diving-related CGE, focusing on single versus repeat regimens and treatment tables used. The questionnaire was distributed via the International Hyperbaric Registry (REDCap), emails to addresses from Oxynet, and a SPUMS member mailing.

Results:

Forty-three units from three regions contributed: Europe including Türkiye (n=22), North America (n=12), Australia/New Zealand (n=9). A symptom-dependent multi-session protocol was the dominant approach for both indications: 35/38 units with an iatrogenic protocol, and the same pattern for diving-related CGE (treated by 36/43 units). Five units had no formal protocol or did not treat CGE. For iatrogenic CGE specifically, 2 units used a single session as default and 1 used a fixed session count. Initial treatment converged across indications on US Navy Treatment Table 6 (or equivalent), used as first table by roughly two thirds of units; a smaller fraction used USN TT5/RN61, USN TT6A or Comex 30 (figure). Repeat treatment was markedly more heterogeneous, distributed across USN TT5/RN61, USN TT9/RN65, and a cluster of bespoke shallower pressure-time profiles (predominantly 2.4 ATA × 90 min). Stopping criteria converged across indications on clinical or neurological response, full symptom resolution, and clinical plateau. The notable difference was that "plateau-plus-one" was applied more often in diving (4 units) than iatrogenic CGE (1 unit). Where units treated both indications, protocols were identical at 28 and different at 7.

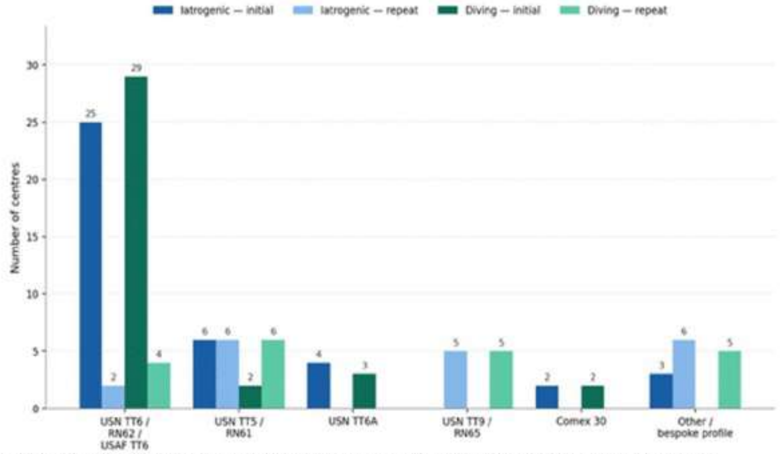

Figure – Hyperbaric tables used as initial vs repeat treatment for iatrogenic and diving-related cerebra l gas embolism (n=43 hyperbaric units). Counts are unique units per category; a unit may use more than one table.

Conclusions: Virtually all responding units now follow a symptom-dependent, multi-session approach, in line with current guidelines. USN TT6 dominates initial treatment, but follow-up table choice and stopping criteria remain markedly heterogeneous, including substantial use of shallower bespoke schedules. Research and data-driven guidance on single versus repeat protocols, and on the type of treatment table used, are needed.

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EUBS2026-O.20

The Use of Hyperbaric Oxygen Therapy in Mass Casualty Events

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Background and Aims: This scoping review aims to evaluate the role of Hyperbaric Oxygen Therapy (HBOT) in mass casualty incidents (MCIs), focusing on its indications, practical challenges, and evidence gaps. The review specifically examines HBOT's potential benefits in managing conditions such as carbon monoxide (CO) intoxications and crush injuries, which frequently arise in disaster scenarios.

Methods: A comprehensive literature search was conducted in PubMed, Cochrane Library, and EMBASE using primary keywords including "Hyperbaric Oxygen Therapy," "Disaster," and "Mass Casualty Incident." Additional pathology-specific terms, such as "CO intoxication" and "Crush injury," were included. After screening 1083 records, 55 relevant articles were analyzed. Data extracted included population characteristics, MCI scenarios, intervention details, outcomes, and logistical challenges.

Results: HBOT was identified as beneficial in managing severe CO poisoning, particularly post-disaster exposure due to power outages and alternative energy sources. Real-world cases highlighted its role in mitigating long-term neurological damage and improving survival rates. HBOT was also effective in treating crush injuries, reducing the need for amputations, and aiding wound recovery when initiated promptly. However, logistical challenges, including limited chamber availability, transport barriers, and the need for specialized personnel, often hindered its implementation in MCIs. Most evidence derives from retrospective studies, emphasizing the real-life applicability but limiting the ability to draw definitive conclusions.

Conclusions: HBOT has significant potential as an adjunctive therapy in MCIs, especially for CO poisoning and crush injuries. However, logistical constraints and the retrospective nature of most evidence pose challenges to its widespread adoption. Proactive disaster planning, including mobile HBOT units, expanded training, and clear triage protocols, is essential to integrate HBOT into emergency response frameworks effectively. Further research is needed to strengthen the evidence base and optimize HBOT's role in disaster medicine.

EUBS2026-O.21

Evaluation of Biomarkers Related to Chronic Endoplasmic Reticulum (ER) Stress in Post COVID-19 Condition

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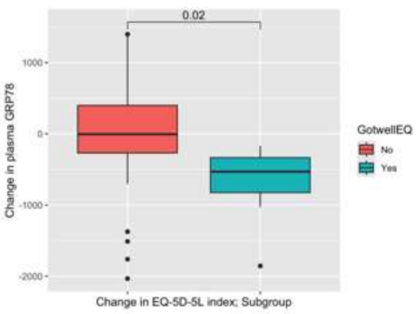
Background and Aims: The burden on health and economy by post-COVID condition, or Long COVID (LC), has surpassed many other chronic diseases, with more than 500 million patients affected globally. More than 200 symptoms have been described, most notably: chronic fatigue and exhaustion. A plethora of biomarkers have been suggested for the main hypotheses of immunological and inflammatory dysfunction - however, none has yet been up to scratch [1]. 40-60 sessions of Hyperbaric oxygen therapy (HBOT) have been shown to improve chronique fatigue and cognitive impairment, but a recent systematic review identified only one RCT supporting this claim [2]. The HOT-LoCO RCT (10 sessions) showed no effect, but large individual variation and sex differences. Patient heterogeneity warrants further search for biomarkers that can predict outcomes. Discussion in our acute COVID-19 trial formed the hypothesis that the unfolded protein response (UPR) and its key chaperone, 78-kDa glucose-regulated protein (GRP78) may be important in disease development in LC [3].

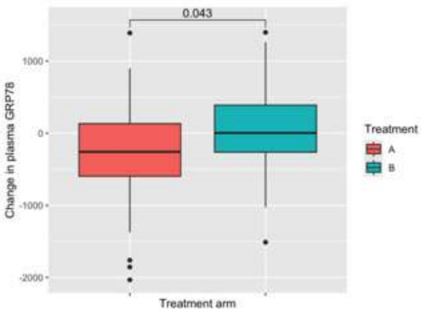
Aim: Evaluate biomarkers related to ER stress, in correlation with clinical variables.

Methods: We used clinical data and biobank material from the HOT-LoCO trial (79 patients received either 10 sessions of HBOT or sham treatment). GRP78 was measured in plasma with Elisa-kit (ENZO, Lasen, Switzerland) and peripheral blood mononuclear cells were analyzed with RNAseq (Illumina, San Diego, CA, USA). GRP78 in plasma was correlated to clinical data using regressionmodels and two-sided Welch tests. Subgroup-analysis were made for treatment arms, sex and clinical outcomes.

Results:

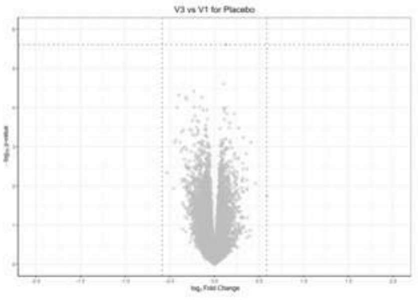
There was a significant difference in change in plasmaGRP78 between treatment arms (t: -2.06, df: 74.43, p: 0.04). Subgroup analyses by sex showed similar trends toward reduced plasmaGRP78 in both sexes. When comparing subjects according to primary outcomes: EQ_5D index and RAND-36 Physical Functioning – those who got better had significantly larger drops in levels of Plasma GRP78 (Mean –696,9 vs –8,8, CI [-1238,-156] vs [-179, 161], p: 0.02) RNAseq showed 7 differentially expressed genes (6 up-, 1 downregulated) in the HBO group vs none in placebo – further analyses are ongoing.





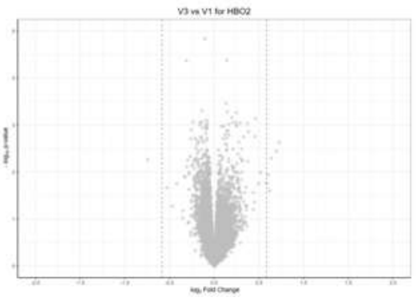
V3 vs V1 for Placebo

Volcano plot



V3 vs V1 for HBO2

Volcano plot



Conclusions: GRP-78 may be a promising biomarker for disease severity/recovery and/or HBOT response in LC.

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EUBS2026-O.22

Managing Hyaluronic Acid Filler Complications: The Role of Hyperbaric Oxygen Therapy - A Case Series

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Case description:

Hyaluronic acid (HA) filler injections are widely used in the cosmetic industry to improve facial volumization beneath surface skin layers. One major complication arising from HA injections is vascular adverse events with a reported incidence of 0.01-0.05%. (2,4). Ischemia can occur instantly or within a few hours, only rarely declaring after a few days (3).

Current recommended practice is to deploy hyaluronidase (HYAL) to breakdown HA filler and reestablish blood flow at occlusion sites (3,5), and hyperbaric oxygen (HBOT) can be used as an adjunct to prevent ischemic complications.

The present case series documents 19 cases of HA-filler-induced vascular occlusion successfully treated with HBOT (larges documented to date). This case series addresses a significant literature gap and provides an evidence-based treatment protocol to implement HBOT in cases of HA-induced vascular occlusion.

A total of 19 female patients with a mean age of 32.6 who experienced HA filler-induced ischemia were included. All cases were staged as per published literature (3). Severe cases were initially treated twice daily at 2.4 ATA for 2 hours in a monoplace chamber. The details of the treatments are in Table 1.

Vascular occlusion after filler injection is thought to be due to either or a combination of direct injection into the artery, vascular spasm, and constriction or embolism migration- even a combination of all (4). Affected areas may be downstream of the injection site and HBOT can improve these distal areas that may not be injected with HYAL.

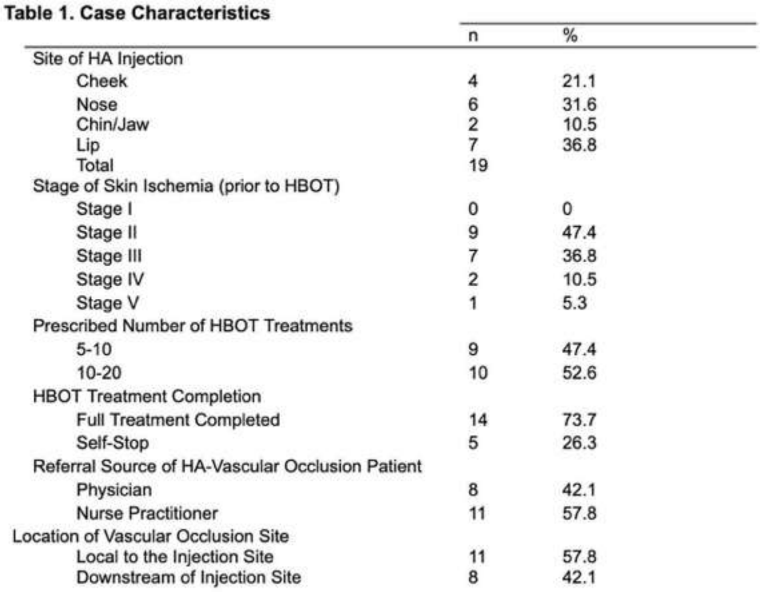

Table 1. Case Characteristics

	n	%
Site of HA Injection		
Cheek	4	21.1
Nose	6	31.6
Chin/Jaw	2	10.5
Lip	7	36.8
Total	19	
Stage of Skin Ischemia (prior to HBOT)		
Stage I	0	0
Stage II	9	47.4
Stage III	7	36.8
Stage IV	2	10.5
Stage V	1	5.3
Prescribed Number of HBOT Treatments		
5-10	9	47.4
10-20	10	52.6
HBOT Treatment Completion		
Full Treatment Completed	14	73.7
Self-Stop	5	26.3
Referral Source of HA-Vascular Occlusion Patient		
Physician	8	42.1
Nurse Practitioner	11	57.8
Location of Vascular Occlusion Site		
Local to the Injection Site	11	57.8
Downstream of Injection Site	8	42.1

Conclusions: This case report demonstrates a promising therapy for HA filler-induced vascular occlusion and ischemia as an adjunct to HYAL injections and suggests an approach to risk stratification and treatment protocol. Finally, it is likely that this complication may be underreported in the literature.

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EUBS2026-O.23

Short-Course Hyperbaric Oxygen Therapy Accelerates Early ACL Graft Maturation: Matched Cohort Study With MRI Assessment

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Background and Aims: Graft ligamentization after ACL reconstruction represents the primary period of mechanical vulnerability, delaying safe return to sport. Hyperbaric oxygen therapy (HBO) stimulates angiogenesis, collagen synthesis, and tissue oxygenation. Leite et al. demonstrated in a rabbit model (5 sessions, 2.5 ATA) that HBO improved graft maturation on MRI, reduced tunnel widening, and enhanced biomechanical properties, subsequently confirmed in humans at 4 months. Whether this benefit is detectable as early as 1 month — during maximum graft vulnerability — and reproducible in an independent cohort, remained unknown.

Methods: Retrospective matched cohort study (HIA Sainte-Anne, Toulon). Twenty-two patients undergoing ACL reconstruction using the DT3+2 technique were included: 12 received 5 daily HBO sessions (2.5 ATA, 90 min, within 10 postoperative days); 10 matched controls received standard care. MRI at 1 and 3 months was assessed by a blinded radiologist. Primary outcome: signal-to-noise quotient (SNQ = [ROI-ACL − ROI-PCL] / ROI-noise), a validated ligamentization marker. Mann-Whitney U test with Benjamini-Hochberg correction was used.

Results: At 1 month, HBO patients showed significantly lower SNQ than controls (median 0.49 vs. 2.76; p = 0.008; p adjusted = 0.017; r = 0.58), exceeding the minimum clinically important difference of 1.5 units. ROI-ACL signal was also lower (21.1 vs. 33.7; p = 0.005). At 3 months, SNQ remained lower (1.45 vs. 2.70; p = 0.038). No tunnel widening differences or serious adverse events were recorded.

Conclusions: A 5-session HBO protocol was associated with significantly accelerated ACL graft maturation from 1 month postoperatively, with a large, clinically meaningful effect size. These findings independently replicate and extend the work of Leite et al. across both animal and human models, providing convergent evidence for HBO as a practical postoperative adjuvant. HBO may shorten the biologically vulnerable period after ACL reconstruction, potentially enabling earlier and safer return to sport. A randomized controlled trial incorporating functional outcomes is warranted.

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EUBS2026-O.24

Hyperbaric Oxygen Therapy for Femoral Head Osteonecrosis: Clinical and Radiological Outcomes From a Hospital-Based Cohort

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Background and Aims: Femoral head osteonecrosis (FHO) is a progressive ischemic bone disorder affecting young and middle-aged adults, frequently resulting in subchondral collapse, pain, disability, and premature total hip arthroplasty (THA). Joint-preserving options remain limited. Hyperbaric oxygen therapy (HBOT) may enhance tissue oxygenation, reduce bone marrow edema, stimulate angiogenesis, and promote bone remodeling. Objectives: To evaluate the clinical and radiological outcomes of a standardized HBOT protocol in patients with FHO treated in routine care.

Methods: We conducted a prospective real-world single-arm interventional cohort study evaluating HBOT with baseline and post-treatment clinical assessments in consecutive patients with MRI-confirmed FHO treated between December 2024 and April 2026 in a hospital-based hyperbaric medicine unit of a secondary care center. All patients received 40 daily HBOT sessions in a multiplace chamber at 2.4 ATA. Baseline variables included demographics, risk factors, laterality, Ficat stage, pain intensity (VAS), and hip function (Merle d'Aubigné score). Outcomes were analyzed per hip and included response, MRI evolution, femoral head collapse, and THA requirement.

Results: Thirteen patients (mean age 44.9 years; 73% male) involving 21 hips were included. Bilateral disease was present in 40% of patients. Most lesions were diagnosed at pre-collapse stages, predominantly Ficat II, with a minority of stage II/III hips. Relevant associated factors included corticosteroid exposure, smoking history, alcohol use, HIV infection, hematological disease, Lyme disease, and oncological disorders. Pain improved in 18/21 hips (86%), while functional scores improved in 19/21 hips (90%). Several patients evolved from moderate-to-severe baseline pain to minimal or absent symptoms after treatment. Serial MRI demonstrated radiological stabilization and/or reduction of bone marrow edema in a proportion of early-stage lesions. During follow-up, 4/21 hips (19%) progressed to femoral head collapse, whereas 5/21 hips (24%) required or were scheduled for THA, mainly among advanced lesions.

Conclusions: HBOT was associated with high rates of symptomatic improvement and radiological stabilization in FHO, particularly in pre-collapse disease. Structural progression and arthroplasty occurred mainly in more advanced lesions. HBOT may represent a valuable joint-preserving therapeutic strategy within a multidisciplinary pathway and warrants prospective controlled studies to define optimal patient selection, treatment timing, and long-term efficacy.

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EUBS2026-O.25

"Hyperbaric Preconditioning Before Ascent to Altitude"

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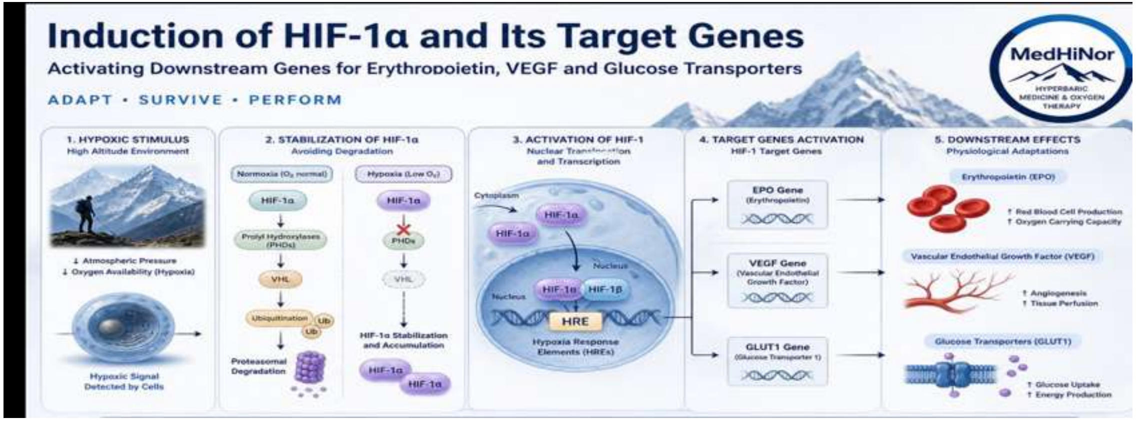
Background and Aims: Acute exposure to high altitude reduces parcial oxygen pressure and may cause acute mountain sickness (AMS), high-altitude pulmonary edema (HAPE), and high-altitude cerebral edema (HACE). Physiological adaptation to hypoxia depends on respiratory, hematological, endothelial, and cellular responses, largely regulated by hypoxia-inducible factor 1-alpha (HIF-1α). Hyperbaric oxygen preconditioning (HBO-PC) has emerged as a potential strategy to improve tolerance to hypobaric hypoxia before ascent to high altitude.
Our hypothesis suggests that intermittent exposure to hyperbaric oxygen induces a “pseudohypoxia” response through oscillating redox stimuli. This hormetic effect activates adaptive pathways similar to intermittent hypoxia, promoting hematological, endothelial, antioxidant, and neurovascular protection. As a result, HBO-PC may increase resistance to AMS and improve functional adaptation at altitudes between 3,000 and 5,000 masl.
The physiological rationale is based on the concept of preconditioning, where controlled sublethal stress activates protective mechanisms against future severe stress.
Intermittent exposure to 100% oxygen at 2.0–2.5 ATA stimulates HIF-1α signaling and downstream genes related to erythropoietin, VEGF, and glucose transporters, preparing tissues for oxygen
deprivation.



Methods: The proposed clinical trial included two groups of 12 healthy mining workers aged 25–45 years. One group received hyperbaric oxygen sessions at 2.5 ATA with 100% oxygen for 45 minutes during three consecutive days one week before ascent, while the control group received no intervention. Measuremente included Lake Louise Survey scores (LLS), oxygen saturation (SpO_2), heart rate (HR), and functional capacity for work at altitude.(FCW)

Results:

Lake Louis Survey: The group treated with HBO-PC had average 3.6 - than 7 control group. p is <0.001 *statistically significant*.

SpO_2: With HBO-PC had average 89.5- than 81.62 control group. $p < 0.01$). *statistically significant*.

HR: With HBO-PC had average 69.12 bpm, than 90.35 control group. $p < 0.005$). *statistically significant*.

FCW Of the 12 who entered the hyperbaric chamber, 10 were fit to start working upon arrival. In the control group, only 2; with *statistically significant* difference

Conclusions:

Our findings indicate that preconditioning wlth HBO, as described in our protocol, reduces the clinical manifestations of altitudes sicknes and prevent symptoms of acute mountain sickness (AMS).

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EUBS2026-O.26

Decompression Strategies Expressed by Gradient Factors: Analysis of 26 Technical, Commercial, and Military Tables

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Background and Aims: Gradient factors (GF) are empirical coefficients introduced by cave diver Erik Baker to modify the Buhlmann algorithm. They are today widely used in technical diving. De Ridder et al. have shown that it is possible to extract GF from a set of US Navy air tables. We have continued this work with 26 tables and identified the GF that best fit their decompression profiles. Our aims are: 1) map GF over the depths and times available in the tables, 2) Characterize and compare decompression profiles between tables; 3) Identify the strategies adopted by the table designers; 4) Attempt to associate these strategies with bubble scenarios.

Methods: We first built a database containing 26 tables, for air, trimix and heliox, used in technical, commercial and military diving. We also collected some specific tables used by Mediterranean coral divers. We then designed an application that emulates the Buhlmann ZHL16C algorithm and GF modifications. We finally used the Simplex minimisation routines to obtain the GF values best fitting the table profiles.

Results: As expected, GF factors vary with depth and time, and as a consequence, with the nature of the bottom mix. However, it seems that the "culture" of the institution in charge of the table design influences the profile of the decompression, as for instance the presence of deep stops. Analysis of profiles seems to indicate three distinct phases: 1) Phase corresponding to the ascent to the first stop; 2) Phase directed by 20-60 min period compartments; 3) Phase directed by slower tissues until saturation is reached. These phases suggest 3 possible relevant bubble scenarios: distal arterial bubbles activated by Boyle's law, shunted arterial bubbles and tissue bubbles.

Conclusions: GF appears as a language that permits the coding of a decompression profile with only two parameters. The decompression profile can be associated with a strategy for sequencing the various bubble scenarios.
It is, however, difficult to evaluate the actual safety performances of a given set of GF. Hence, it seems that different strategies may be used for a given decompression

EUBS2026-O.27

Acute CO_2 Exposure Doesn't Affect the Expired Nitric Oxide Decrease Following a Hyperbaric Oxygen Dive

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Background and Aims: Previous studies have found an oxygen dose dependent temporary decrease in expired nitric oxide (NO_e) following a dive[1]. The relationship between the relative decrease in post-dive NO_e from pre-dive NO_e levels and oxygen dose follows an exponential decline and may be a measure of pulmonary oxidative stress[1]. However, it is unknown if other factors, such as elevated CO_2, impact this relationship. The aim of this study was to determine if the hyperoxia mediated decrease in NO_e following a dive is impacted by exposure to CO_2.

Methods: Twelve male U.S. Navy trained divers (mean [SD] age 31 [3.7] yrs, body mass 88.3 [10.8] kg) underwent two resting dry hyperbaric oxygen exposures for two hours at two ATA in a hyperbaric chamber. During one dive, they breathed 100% O_2 (HBO) and during the other, 1.5% CO_2 balance O_2 ($HBOCO_2$) in a counterbalanced order. The gas conditions were presented in a subject-blinded fashion via the built-in breathing system, in which the oral nasal mask was modified to measure minute ventilation. NO_e was measured immediately before and after each dive in accordance with American Thoracic Society methodology.

Results: The CO_2 exposure resulted in a 66% mean increase in minute ventilation (BTPS) during the $HBOCO_2$ dive compared with the HBO dive (11.3±2.1 vs 18.8±3.8 l/min, $p<.001$). Pre-dive NO_e levels were similar (HBOpre= 18.9±7.5 ppb, $HBOCO_2$pre= 18.0±6.1 ppb, $p>.05$) and decreased significantly following both dives (HBOpost= 12.3±4.4 ppb, $HBOCO_2$post= 13.8±6.0 ppb, both $p<0.001$). The mean $HBOCO_2$ post-dive NO_e was not significantly different from the mean HBO post-dive NO_e.

Conclusions: Acute exposure to moderate levels of CO_2 during an HBO dive does not significantly affect the hyperoxic-mediated decrease in NO_e. We suggest that NO_e may provide a noninvasive measure of the level of lung oxidative stress resulting from prolonged HBO exposures, which is independent of any increases in ventilation resulting from acute CO_2 exposure.

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EUBS2026-O.28

Modeling Gas Exchanges to Identify Pertinent Physiological Parameters for Personalised Decompression

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Background and Aims:

Our goal being to develop personalized decompression procedures, we proposed a new physiological model of gas exchanges during diving [1,2]. This model includes 24 biological compartments and a large number of physical, morphological and physiological parameters. This complexity is both its strength and drawbacks. We used a Sobol analysis on our model in order to hierarchize the parameters (in terms of impact on the t1/2) and identify the pertinent parameters that could be interesting to measure during a dive to set the model and individualize decompression.

Methods:

We developed an algorithm to parallelize Sobol Sensitivity Analysis. A Sobol approach is a method that quantifies how much each input parameter (alone and through interactions with other parameters) contributes to the total variance of a model output. It allows identification of the parameters that most strongly control model behavior. We ran a Sobol analysis on 12 input parameters (respiratory flow and volumes, blood flow and volume, alveolocapillary diffusion, tissular diffusion, tissular volumes) on the half saturation time for nitrogen.

Results:

We developed our own GPU parallel implementation to deal with the important computation requirement of the Sobol analysis, with 12 inputs parameters. As compared with a Python implementation on a CPU, our GPU simulation speed is 1000 times quicker (3 minutes vs 48 hours). The GPU simulation code and the application are available online [3,4]. Our simulation shows that the two more important parameters are: the blood flow (first order Sobol index : 0.97, interactions : 0.38) and the tissue volume (first order Sobol index : 0.00, interactions : 0.59). The blood flow is the most influential parameter and acts by itself contrary to the tissue volume that influences t1/2 through interaction with other parameters.

Conclusions:

Haldanian models are based on the hypothesis that gas transfer is controlled by blood flow [4]. Our conclusions confirm this hypothesis : the blood flow exert a massive influence on t1/2 in our system. The sobol analysis opens new perspectives and also shows that other parameters can have an influence on the t1/2 : eg tissular volume that should be integrated in personalized decompression procedures.

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EUBS2026-O.29

Frequency and Patient Care Data After Diving Accidents at a Popular Diving Lake in Germany

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Background and Aims: Data concerning the frequency of diving accidents are based on case reports and registry data (1). Kreidesee Hemmoor is a popular lake with dive permissions for about 37,500 sports and technical divers with around 75,000 dives annually. Visibility, water depth, and cold temperatures represent particular challenges. Emergencies are managed by regional EMS or in conjunction with HEMS; patients requiring hospitalization are taken to the hospital in Stade, Germany, or to supraregional centers by HEMS.

Methods: Data from all rescue missions at Hemmoor and from patients treated for a diving accident (ICD10 T70.0/T70.1 Barotrauma und T70.3 Decompression sickness, (DCI) at the hospital in Stade in the years 2023-2025 were evaluated retrospectively. All data protection criteria from the participating centers were considered.

Results: 43 patients [65.1% male, age 42 (15-84) years] were documented: for 39 (90.7%) Kreidesee was identified the EMS site. In the years 2023, 2024, and 2025, rescue mission rates of 37%, 28%, and 35%, respectively, were reported (peak in summer months). After treatment at the rescue site, three patients each (7.3%) remained at the site or were pronounced death there. 28 (68.3%) were taken to Stade hospital and seven (17.1%) were transfered to supraregional centers by HEMS. 31 (72.1%) were treated for a diving accident; 12 (27.9%) for other diagnoses. During the study period, 31 diving accidents occurred among 225,000 dives (13.8/100,000 dives). The 28 (90.3%) who were taken to Stade by EMS and another two patients who self-admitted (6.5%) could be further evaluated. Ultimately, 35.5% who were treated as outpatients and 19.7% treated in the hospital, mostly in intensive care, could be discharged; 11 (35.5%) were transferred to a hyperbaric medical center (for 3 (9.7%) no information)

Conclusions: At 13.8/100,000 dives, diving accidents are rare but the actual frequency is likely higher than it appears from the registry data. Particularly in regions where there is considerable diving activity, emergency services, air rescue, and hyperbaric medical centers should work together to develop and establish management plans.

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EUBS2026-O.30

International Standardisation in Underwater Operations – an Opportunity

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Case description: Presenting a newly established ISO Working Group, WG 16 for Underwater Operations at the International Standards Organisation (ISO)

The WG 16, established under *Technical Committee (TC67) for Oil and gas industries including lower carbon energy* shall take on projects within remote- and manned underwater operations.

At EUBS 2026 we focus on the potential for standardisation in manned underwater operations, meaning both surface-oriented diving and saturation diving.

Working group 16 is currently promoting itself, both to attract a wider range of experts that could be interested in joining the working group and/or experts who wish to propose potential projects for international standardisation.

We hope to attract experts representing regulators, physiologists and researchers, unions, diving contractors, equipment manufacturers, classification societies, navies and Oil & Gas operators.

The establishment of Working Group 16 for Underwater Operations, of which I'm the elected Convenor, was approved by ISO member countries in January 2025.

Our current project is to establish an updated ISO standard for *Respiratory equipment, Breathing apparatus performance requirements for diving and hyperbaric applications*, which is well underway.

Conclusions: I will present the opportunity for the wider diving community to establish international standards for underwater operations in ISO. I will give some examples of potential topics for future standardisation with a focus on commercial diving, including explaining the process for proposing ISO-standardisation projects. Also, our working group calls on the attendees and organisations to nominate relevant experts to join the working group through their national standardisation bodies.

EUBS2026-O.31

VAC™ Devices in the Hyperbaric Chamber: Heterogeneous Practices and Urgent Need for Consensus Guidelines

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Background and Aims: Hyperbaric oxygen therapy (HBOT) plays an important role in the management of complex wounds. Some patients simultaneously undergo negative pressure wound therapy (NPWT), particularly using VAC™ systems. At our institution in Geneva, the VAC™ manufacturer's instructions recommend opening the tubing clamps and covering them with dry gauze during hyperbaric treatment. However, this guidance raises concerns, as it does not allow connection to an external suction source to maintain NPWT during the HBOT session. This study aims to explore current practices regarding VAC™ device management during HBOT across francophone hyperbaric centers.

Methods: An anonymous 13-item survey was distributed between February and April 2026 to francophone hyperbaric medicine centers affiliated with the ICHF, via professional mailing lists. It explored the frequency of VAC™ management in the hyperbaric chamber, the existence of local protocols, standard procedural practices, reported incidents, perceived clarity of the literature, and interest in harmonized guidelines.

Results: Forty-one responses were collected from 24 unique francophone hyperbaric centers. Nearly all centers reported managing patients with VAC™ devices in the hyperbaric chamber, yet only 7.5% had a formal written protocol. Reported practices were heterogeneous, particularly regarding motor removal, tubing management, reservoir handling, and use of chamber suction. One quarter of centers reported at least one incident. Finally, 37 out of 41 respondents (89.7%) supported the development of harmonized recommendations.

Conclusions: The combined use of VAC™ systems and HBOT is common but poorly regulated. These preliminary findings highlight the need for consensus guidelines adapted to the hyperbaric environment, in order to standardize practices and enhance patient safety.

EUBS2026-O.32

Transient and Reproducible Lung Ultrasound B-Lines During Repeated Immersion in Military Diver Candidates

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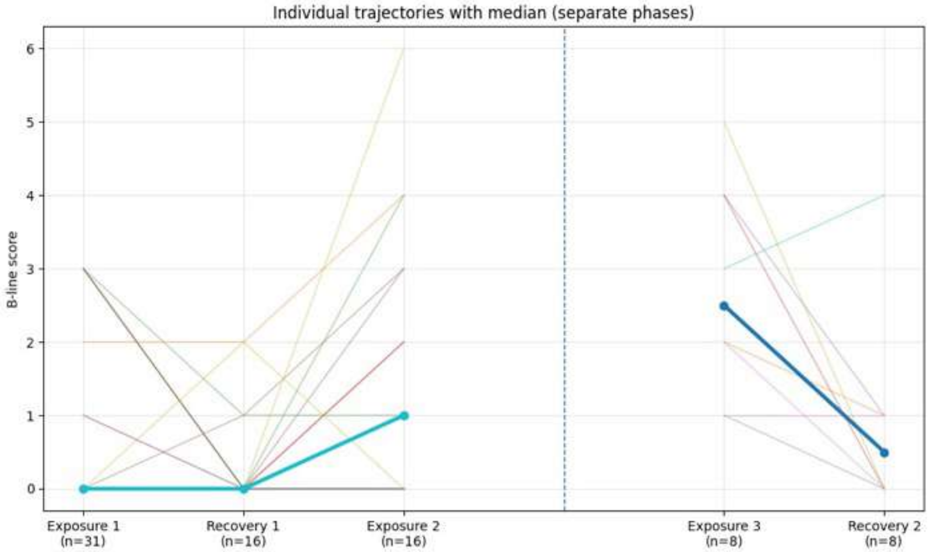
Background and Aims: Swimming-induced pulmonary oedema (SIPE) is a potentially life-threatening condition in divers, with a higher reported incidence in military trainees (1.8–5%) than in civilian open-water swimmers (~0.44%). Lung ultrasound (LUS) can detect increased interstitial pulmonary fluid based on B-line artefacts. However, the incidence and significance of B-lines following strenuous water immersion remain unclear. We aimed to characterise pulmonary responses during selection training in military diver candidates using LUS and clinical parameters.

Methods: In this prospective observational cohort study, Swedish Armed Forces diver candidates were assessed during routine selection training. Participants underwent pool drills (90 and 120 minutes, ~27 °C; exposures 1–2) and an open-water swim (~120 minutes, ~13 °C; exposure 3). LUS using a standardised 12-zone protocol was performed post-exposure and after recovery. Participant numbers decreased across exposures due to selection. B-line score was the primary outcome, and ≥1 B-line was a secondary outcome. Clinical data included vital signs and symptoms. Non-parametric analyses and a generalised linear mixed-effects model were applied.

Results: Altogether, 34 candidates were included. Thirty-one initiated the first pool drill (exposure 1), of whom 16 completed a repeated pool drill (exposure 2). Eight candidates later in training completed an open-water swim (exposure 3).

B-line scores varied across timepoints, with higher values after immersion, lower values after recovery, and increasing values upon re-exposure (recovery 1 to exposure 2; p = 0.020) (Fig. 1). A significant overall effect of timepoint was observed (p = 0.021), demonstrating a reproducible and reversible pattern of B-line changes.

Participants completing exposure 1 (90 minutes) had a higher prevalence of ≥1 B-line than those terminating early (62.5% vs. 20%, p = 0.034), while total B-line score did not differ. After open-water exposure, all participants (100%) demonstrated ≥1 B-line, with reduction after recovery. No participant developed clinical SIPE, and oxygen saturation remained ≥94%.



Conclusions: Transient increases in lung ultrasound B-lines are common after strenuous water immersion in military diver candidates, resolving with rest and recurring upon re-exposure. These findings suggest that increased interstitial lung water represents a physiological response to exposure and may support the concept that SIPE develops along a continuum.

EUBS2026-O.33

Severe Presentations of Immersion Pulmonary Edema: Insights From a 14-Year Retrospective Cohort Study

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Background and Aims: Immersion pulmonary edema (IPE) may rapidly lead to life-threatening events. Determinants of initial severity upon exiting the water remain poorly characterized.

Methods: We retrospectively analyzed consecutive IPE cases managed in a French national hyperbaric referral center (2010–2023). Severe IPE was defined by acute respiratory distress, loss of consciousness, or cardiac arrest at water exit. Clinical and dive-related variables were assessed using logistic regression.

Results: Among 288 cases, 90 (31.3%) were severe at water exit. Severe presentations included acute respiratory distress (63.4%), loss of consciousness (32.2%), and cardiac arrest (4.4%). Scuba diving accounted for 79.9% of cases.

In univariate analysis, active smoking was associated with severity ($p = 0.048$). Among scuba divers, inadequate decompression ($p < 0.001$) and shorter dive duration ($p = 0.001$) were associated with severity.

In multivariate analysis, the variables included (active smoking, breath-hold diving and professional diver status, respectively $p = 0.053$; $p = 0.069$; $p = 0.080$) were not statistically significantly associated with IPE severity. The multivariate model demonstrated adequate fit and no collinearity but had very low predictive power, indicating limited ability to explain IPE severity.

Conclusions: Severe IPE is frequent and occurs early: nearly one-third of cases are severe after exiting the water. The absence of strong predictive factors suggests that severity is poorly predictable using baseline characteristics alone. Associations with dive profile parameters likely reflect behavioral or physiological consequences of early symptom onset rather than causal mechanisms.

Take-home message: IPE severity appears rapid, unpredictable, and operationally decisive, supporting a strategy focused on early recognition, immediate extraction, and prompt management, rather than risk stratification alone.

EUBS2026-O.34

Freediving Competition “Safety Divers” Exhibit Pulmonary Stress but Not Decompression Strain After Repetitive Breath-Hold Dives

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Background and Aims: Repetitive breath-hold diving induces hypoxia-reoxygenation cycles and hydrostatic stress. Although decompression illness is traditionally associated with compressed-gas diving, neurological events have been reported after repetitive breath-hold dives. The decompression stress, pulmonary effects, and inflammatory responses in breath-hold safety divers remain unclear.

Methods: Fourteen safety divers (11 males, 3 females; 35±6 years) performed 174 dives (mean depth 18.8±12.3 m) during the AIDA Depth World Championship 2025 (Limassol, Cyprus). Vascular gas emboli (VGE) were assessed by echocardiography, pulmonary B-lines by lung ultrasound, salivary IL-6 and TNF-α by ELISA, and hydration by bioimpedance spectroscopy. Measurements were collected pre- and post-dive over two competition days and at 24-h and 48-h recovery. Linear and generalized linear mixed-effects models with Holm-corrected contrasts were used.

Results: No VGE were detected. Pulmonary B-lines increased significantly post-dive on Day 1 (rate ratio=1.60; p=0.037) and Day 2 (RR=2.30; p=0.0008), returning below baseline at 48-h recovery (RR=0.25; p=0.0003). Salivary IL-6 peaked at 24-h recovery (+6.52 pg·mL^{-1}; p<0.0001), remaining elevated at 48 h (p<0.0001). TNF-α rose from Day 2, reaching +25.16 pg·mL^{-1} at 48-h recovery (p<0.0001) with no return toward baseline. Hydration remained stable (p=0.69).

Conclusion: moderate inflammation was observed up to two days following safety BH sessions. The BHSDs did not demonstrate any VGE, but rather exhibited pulmonary B-lines consistent with the observed inflammation. Despite the absence of documented incidents or accidents, including but not limited to pulmonary oedema and DCS, it is strongly recommended that BHSDs allocate additional days for recovery, with the aim of reducing potential health risks.

Conclusions: Moderate inflammation was observed up to two days following safety BH sessions. The BHSDs did not demonstrate any VGE, but rather exhibited pulmonary B-lines consistent with the observed inflammation. Despite the absence of documented incidents or accidents, including but not limited to pulmonary oedema and DCS, it is strongly recommended that BHSDs allocate additional days for recovery, with the aim of reducing potential health risks.

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EUBS2026-O.35

Cardiac Biomarkers and Lung Ultrasound Changes After Scuba-Diving: Predictor of Risk for Immersion Pulmonary Oedema?

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Background and Aims: Immersion pulmonary oedema (IPO) is a serious and often recurrent condition in SCUBA-divers, with increasing relevance with a growing population of aging divers. Its pathophysiology is thought to involve immersion-related cardiopulmonary stress and has been linked to (usually unknown) pre-existent cardiac risk factors, but objective markers to identify individuals at increased risk remain limited.

Objectives: To evaluate whether divers with a prior history of IPO demonstrate a greater post-dive increase in cardiac biomarkers and lung ultrasound (LUS) scores following a standard no-decompression dive, compared with case-matched controls (age, sex, BMI, OC vs CCR, drysuit vs wetsuit).

Methods: Twenty-five divers were enrolled, including seven divers with a documented history of IPO, medically cleared to dive again, and eighteen case-matched control divers without prior IPO. All participants performed a regular no-decompression recreational dive under comparable conditions (in-shore quarry, no current, comparable water temperatures). Blood sampling and lung ultrasound examinations were performed immediately before and after the dive. Biomarkers analysed included NT-proBNP and cardiac troponins. Lung ultrasound assessed pulmonary interstitial changes using standardized B-line scoring. Pre- to post-dive changes were evaluated within and between groups.

Results: Preliminary statistical analyses indicate a significant post-dive increase in NT-proBNP, cardiac troponins, and LUS scores in divers with a history of IPO. These changes were not observed to the same extent in control divers. Exact effect sizes and final statistical models are currently being finalized.

Conclusions: Initial findings suggest that divers with previous IPO experience a more pronounced cardiopulmonary response to an otherwise uncomplicated no-decompression dive. If confirmed, the degree of post-dive changes in cardiac biomarkers and lung ultrasound findings may represent a new and important research avenue to better identify divers at increased risk of immersion pulmonary oedema. This research could support the development of preventive screening or monitoring strategies, particularly in aging diver populations.

EUBS2026-O.36

Diving With Cardiac Implantable Electronic Devices: Safety in Era of Modern Pacemakers, Implantable Cardioverter Defibrillators

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Background and Aims: Recreational diving has traditionally been considered a relative or absolute contraindication in patients with cardiac implantable electronic devices (CIEDs), including pacemakers and implantable cardioverter defibrillators (ICDs). Concerns include device malfunction under hyperbaric conditions, lead integrity compromise, arrhythmia risk, and inappropriate shocks. However, there have been advances in device engineering and improved pressure tolerance testing. The aim of this study is to evaluate the safety considerations, physiological interactions, and current evidence surrounding diving in individuals with CIEDs, and to propose a contemporary risk stratification framework.

Methods: This is a comprehensive review of physiological effects of immersion and pressure on the cardiovascular system, device technical specifications and hyperbaric testing data, published case series, surveys, experimental studies and diving medicine guidelines.

Results: Physiological changes during immersion include central blood volume shift, increased preload and afterload which may increase arrhythmogenic risk in susceptible individuals. Survey data suggest that some individuals with CIEDs continue to dive. Risks of device malfunction under hyperbaric conditions, lead integrity compromise, arrhythmia risk, and inappropriate shocks may potentially result in incapacitation underwater. Modern pacemakers are generally designed to withstand pressures equivalent to recreational diving depths (~30–40 m), although variability exists across manufacturers. Experimental and observational data on device performance under hyperbaric conditions remain limited, with few reports of device malfunction despite increasing clinical use. Technical reviews highlight the absence of standardized manufacturer guidance and emphasize variability in device pressure tolerance and lack of formal underwater validation. Risks associated with diving in patients with CIEDs is multifactorial and can be assessed in a proposed **Device-Patient-Dive (DPD)** risk stratification framework as shown in the table.

Device-related factors	Device pressure tolerance and hermetic sealing Lead durability and mechanical strain
Patient-related factors	Underlying cardiac disease Pacemaker dependence History of malignant arrhythmias
Dive-related factors	Depth Duration Environmental stressors Exertion

Conclusions: Current recommendations on diving with cardiac implantable electronic devices remain conservative, largely due to limited prospective data rather than definitive evidence of harm. Diving in patients with pacemakers may be feasible in carefully selected individuals following a comprehensive Device-Patient-Dive (DPD) joint evaluation by the cardiologist and diving medicine physician, while ICD implantation remains a relative contraindication. There is a critical need for prospective registries, device-specific testing standards and updated consensus guidelines to ensure diving safety in the era of modern pacemakers and implantable cardioverter defibrillators.

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EUBS2026-O.37

Amount of Settled Dipalmitoylphosphatidylcholine in the Heart of Rats Does Not Correlate With Decompression Illness

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Background and Aims: The lung surfactant dipalmitoylphosphatidylcholine (DPPC) settles on the luminal aspect of blood vessels to form active hydrophobic spots (AHS). The nanobbubles which develop at these spots are the gas micronuclei from which decompression bubbles expand upon decompression. Variability between “bubblers” and “non-bubblers” is derived from the variability in the AHS. We expected that the level of DPPC in the heart will correlate to the severity of decompression illness (DCI).

Methods: Thirty-six rats were exposed to 8 bar for 33 min

Results: After decompression they were examined for DCI and defined as non-DCI rats (ND, n=18), DCI inflicted rats (DCI, n=13), and dead rats (DEATH, n=5). DPPC concentration in the hearts (mg/g) was 2.97 ± 0.56 SD for ND, 2.87 ± 0.62 SD for DCI and 2.81 ± 0.46 SD for DEATH

Conclusions: There was no significant difference between the 3 groups. The results are discussed and a further study to explore correlation between bubbling and heart DPPC is suggested.

EUBS2026-O.38

Preliminary Results of the "OXYBAR" Study : Impact of Repeated HBO on Post-Radiotherapy DNA Damage

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Background and Aims: A single hyperbaric oxygen (HBO) exposure increases the formation of reactive oxygen species (ROS), thereby possibly causing oxidative DNA damage; the latter is normally rapidly repaired and even triggers adaptive protection [1]. Equivocal data is available on the impact of repetitive HBO on oxidative DNA damage.The vast majority of these studies originates from healthy volunteers, whereas scarce data only is available from patients with general conditions per se associated with enhanced oxidative DNA damage and/or compromised DNA repair, ultimately triggering the discussion whether "*HBO has a cancer-causing or promoting effect*" [2]. Therefore, the "OXYBAR" study investigates the effect of repetitive HBO exposures on ROS production, DNA damage, and oxidative stress in patients with complications after radiotherapy for neoplasia.

Methods: Up to now 60 patients have been included, of whom 47 underwent HBO (2 hrs at 2.5 bar) for complications of radiotherapy ("radiotherapy"), and 13 for other HBO indications in the absence of radiotherapy ("control"). Prior to and both immediately after the 1st as well as the last HBO session (n = 20 - 47 and 7 - 30 in the "cancer patients" and "controls", respectively) we measured whole blood superoxide anion formation ("CMA" [nmol/sec]; [3]) and DNA single strand breaks (single cell gel electrophoresis: "tail moment" in the alkaline comet assay; [3,4]) together with plasma 8-isoprostanes [5] and 8-hydroxy-2-deoxy-guanosine [6] (commercial ELISA kits), i.e., markers of lipid peroxidation and DNA damage, respectively. After exclusion of normal data distribution intragroup time-dependent effects were tested using a Kruskal-Wallis test for multiple rank sum comparisons together with an unpaired rank sum test for intergroup differences at the 3 measurement points.

Results: No matter the group assignement, so far, we did not find any evidence for deleterious effects of repetitive HBO exposures on DNA integrity or for aggravation of oxidative stress, respectively.

Conclusions: Our preliminary data suggests that even 30 - 40 therapeutic sessions are safe with respect to DNA integrity and/or oxidative stress in patients undergoing repetitive HBO therapy as an adjunct for the treatment of complications of radiotherapy for malignancy ("OXYBAR", NC06999785).

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EUBS2026-O.39

Soft Tissue Radiation Injury; Patient Reported Evaluation in a Single Centre Cohort Study (STRIPE)

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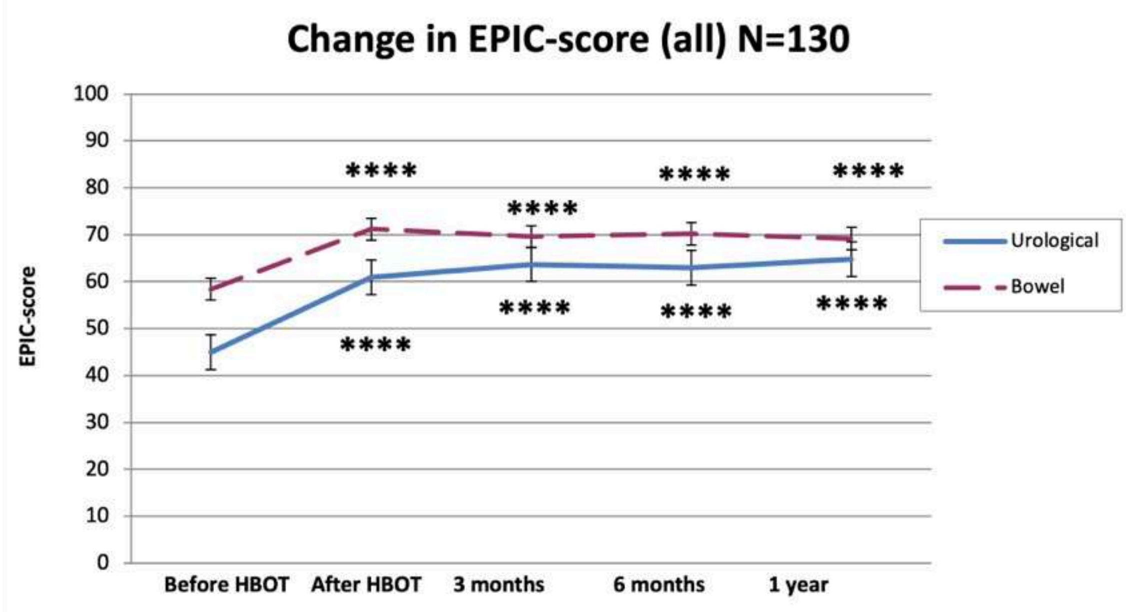
Background and Aims: Late radiation-induced tissue injury (LRTI) affects 5–10% of patients after pelvic radiotherapy and may result in persistent urinary and bowel symptoms, and reduced health-related quality of life (HRQoL). Hyperbaric oxygen therapy (HBOT) is an established treatment for patients with LRTI and has been shown in randomized studies to improve symptoms and HRQoL. However, only a minority of affected patients are referred for treatment. STRIPE aims to longitudinally characterize patients with LRTI treated with HBOT at Karolinska University Hospital and identify factors associated with treatment response, with the goal of improving patient selection, timing, and outcomes. We here report preliminary Expanded Prostate Cancer Index Composite (EPIC) data from the retrospective cohort.

Methods: STRIPE is an observational longitudinal cohort study with assessments before and after HBOT, integrating clinical data, patient-reported outcomes, and biomarkers. The study comprises two cohorts with harmonized variable definitions: a retrospective cohort (n=130) based on a clinical quality registry and medical records, and an ongoing prospective cohort (target n≈1,000) enrolled after informed consent. Data include clinical characteristics, treatment variables, and validated patient-reported outcome measures, including the EPIC, EQ-5D, and RAND-36. Preliminary analyses of the retrospective cohort used t-tests to compare change from baseline after HBOT and at 3, 6, and 12 months. Missing follow-up data were handled using last observation carried forward. Results are presented as mean (SD).

Results:

EPIC data were available for 130 patients. Twenty-seven had not completed 1-year follow-up and were excluded from the present analysis; 103 had at least two assessment timepoints. Mean age was 66.4 years (SD 13.5), and mean time from radiotherapy to HBOT was 6.3 years (SD 6.0). Baseline mean EPIC scores were 45.0 (SD 27.0) for urinary symptoms and 58.4 (SD 18.8) for bowel symptoms. At 1-year follow-up, mean scores had improved to 64.8 (SD 25.6) and 69.2 (SD 18.6), respectively.



Conclusions: In this retrospective single-centre cohort, HBOT was associated with clinically meaningful improvement in patient-reported urinary and bowel symptoms up to 12 months. Further analyses are warranted to identify clinical phenotypes and predictors of response and non-response.

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Effects of Diving on Platelet Inhibitory Cyclic Nucleotide Signalling

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Background and Aims: Platelets are key players in haemostasis and inflammation. Platelet responses are shaped by a complex interplay between intra- and intercellular signalling processes. Key to this is the balance between activatory and inhibitory signalling pathways, the latter of which is mediated through cGMP and cAMP. In diving, platelet activation has been found associated with decompression stress. It is unknown how inhibitory cGMP and cAMP signalling in platelets responds to diving related exposures. We monitored the activity of these signalling pathways in both *ex vivo* models using simulated diving and in washed platelets from pre- and post-diving blood samples from divers.

Methods: Washed platelets were isolated from whole blood EDTA or Na-citrate tubes using a series of centrifugation steps and were stimulated prior to analysis. Sodium nitroprusside (SNP), Iloprost (Ile) and their synergistic signalling interaction were monitored using phospho-specific antibodies against Ser157 and Ser239 of vasodilator-stimulated phospho-protein (VASP) – a well-established target protein of PKG and PKA. Platelet activation and the inhibition of activation by SNP or Ile were assessed using the Multiplate® analyzer in whole blood.

Results: Analysis of blood samples from divers (N=9) pre- and post-diving with nitrox (EAN36, 21±4msw, 30±1.5min) showed only moderate changes in platelet cAMP and cGMP signalling. The response to SNP was decreased in 6 of 9 divers and a significant, but moderate, decrease in synergistic SNP/Ile signalling was found. The individual variation in Ile signalling was largest and a likely cause of variation in the combined SNP/Ile response. Simulated diving (30min) using washed platelets from four different donors (A: pO_2-20kPa, pN_2-280kPa; B: pO_2-120kPa, pN_2-180kPa) showed insignificant changes for nitrox (B), whereas pressure only (A) stimulated Ile and SNP/Ile signalling. A moderate, but significant decrease in Ile mediated inhibition of ADP-mediated platelet activation was observed after one simulated dive (B=EAN40, 20msw, 30min) with Na-citrate whole blood.

Conclusions: Platelet cGMP and cAMP signalling through VASP is robust and largely conserved after diving. The cAMP mediated inhibition of ADP-activated platelet aggregation is only moderately decreased. There were large individual variations in the signalling responses.

EUBS2026-O.41

Hyperbaric Oxygen Therapy for Treating Late Effects of Pelvic Radiation Injury in Female Patients

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Background and Aims: It is estimated that nearly 50% of all cancer patients receive radiation therapy (RT) with a significant portion including pelvic RT.[1] In female patients, pelvic RT is used to treat cancers of the cervix, uterus, rectum and anus.[2] Late stage pelvic injuries from RT occur in 5-10% of patients and manifest as radiation cystitis/ enteritis/ proctitis, sexual dysfunction, and breakdown of soft tissues in the affected areas.[2,3] Hyperbaric oxygen therapy (HBOT) is an important adjunctive therapy to consider for cancer survivorship in female patients with late injuries from RT.

Methods: This single center, retrospective study identified female patients >18 years who presented for HBOT consult between May 2018-March 2026 with an associated diagnosis of late RT injury. Chart review identified female patients with pelvic RT injuries, specifically. Key characteristics were collected including age, diagnosis, radiation dose, symptoms, and treatment course.

Results: There were 259 females referred to HBOT with a diagnosis consistent with late RT injury. Of those, 105 females were found to have a late RT injury within the pelvis. The average age was 60 years. Most common cancer diagnoses were cervical squamous cell carcinoma, colorectal adenocarcinoma, and vulvar/ vaginal/ anal squamous cell carcinomas. The average radiation dose received was 73.4 cGy. Most common presenting symptoms included nonhealing wounds or tissue breakdown (including fistulas and ulcers), radiation cystitis/proctitis/ enteritis, and pain.

There were 68 females who proceeded with HBOT at our institution's facility. Of those, 43 completed 50% or greater of the recommended HBOT sessions. Improvement was documented in 86% of these patients. Reasons for early discontinuation included transfer to a facility closer to home, complications of HBOT (ear barotrauma, gastrointestinal symptoms, claustrophobia), transportation barriers to HBOT facility, disease progression, or meeting therapy goals early.

Conclusions: HBOT plays an important role in survivorship for female patients who receive pelvic RT and experience late effects of radiation injury. Our retrospective review showed improvement in 86% of female patients who completed 50% or more of recommended HBOT sessions. Of note, barriers to treatment or early discontinuation of therapy was prevalent in this population. Future prospective studies are needed.

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EUBS2026-O.42

Hyperbaric Oxygen Therapy in Refractory Necrotic Ulcers Due to Livedoid Vasculopathy: A Case Report

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Case description: A 21-year-old woman was referred for management of necrotic lower limb ulcers in the context of livedoid vasculopathy. She had been under multidisciplinary follow-up since November 2024 for suspected mixed connective tissue disease (systemic sclerosis and systemic lupus erythematosus), with multisystem involvement including painful necrotic ulcers of the lower limbs, sclerodactyly, digital ulcerations, granulomatous anterior uveitis, and arthralgia. In December 2024, she was hospitalised for severe thrombocytopaenia requiring corticosteroids and intravenous immunoglobulin. Skin biopsy of the thigh showed lobular panniculitis with vasculitis and necrosis. CT angiography identified occlusion of the distal left peroneal artery, though vascular surgery considered the cutaneous findings disproportionate to the degree of obstruction; anticoagulation with edoxaban was nonetheless initiated. Despite treatment with corticosteroids, intravenous immunoglobulin and vasodilators (bosentan), the necrotic ulcers persisted. At our initial assessment 9 months after, two significant ulcers were present, the larger on the left leg, both with regular borders, granulation tissue, and no active signs of infection. Treatment with hyperbaric oxygen was delayed one week due to recent open-angle glaucoma surgery, given the risk of intraocular gas. Clinical progress was monitored quantitatively. After 20 sessions (2.5 ATA, 70 min O_2), the primary ulcer area reduced from 12.4 cm² to 2.5 cm², and the perimeter decreased from 156 mm to 75 mm. By session 40, the right limb ulcers had achieved complete epithelialisation, and the left limb wounds showed active granulation with significant size reduction. The patient completed a total of 56 sessions, achieving complete wound closure of all lesions despite ongoing systemic disease activity.

Conclusions: This case highlights the efficacy of HBOT as a synergic weapon in treating complex, necrotic ulcers secondary to autoimmune vasculopathy. The rapid reduction in wound area, alongside full epithelialisation, supports HBOT in complex ulcers driven by autoimmune vasculopathy, even in the setting of ongoing systemic disease activity.

EUBS2026-O.43

Hypertension Management in Elective Hyperbaric Oxygen Therapy: Pathway Development and Threshold Derivation

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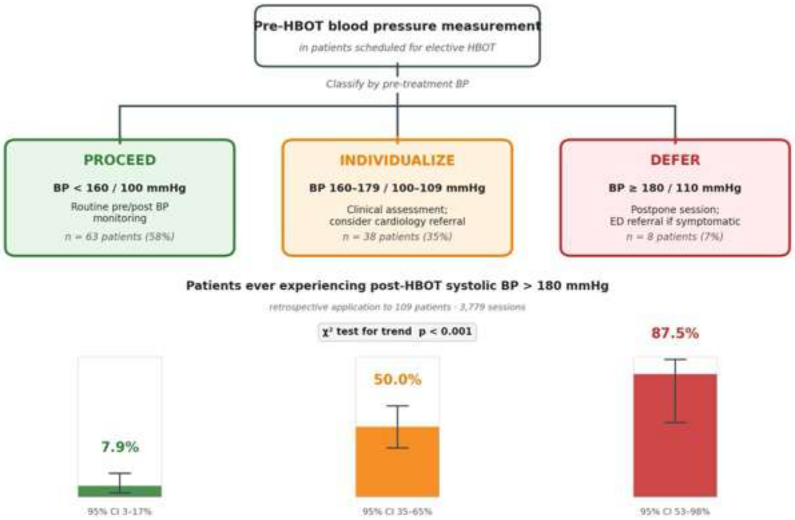
Background and Aims: Hypertension is the most prevalent cardiovascular comorbidity among patients undergoing elective hyperbaric oxygen therapy (HBOT). Hyperoxia produces predictable post-treatment elevations in arterial blood pressure (BP) through several mechanisms including vasoconstriction, nitric oxide suppression, and endothelin-1 upregulation. However, no international guidelines exist for managing hypertension in HBOT, and clinical practice varies between centers. We aimed to develop a structured care pathway with day-of-treatment thresholds anchored in current hypertension guidelines and to validate it in a retrospective cohort.

Methods: Pathway development followed a collaborative process between hyperbaric medicine and cardiology, integrating data from our institutional registry (Schiavo, 2020), current hypertension guidance (ESH 2023; ESC 2024), and structured pre-HBOT cardiology consultation framework. Day-of-treatment thresholds were selected from ESH 2023 grade 2/3 cutoffs and retrospectively applied to our cohort describing 3,779 elective HBOT sessions in 109 patients (median 37 sessions/patient, (range 2-62)). Patients were classified by the highest-risk category reached during their treatment course: "proceed" (all pre-treatment BPs <160/100 mmHg), "individualize" (≥1 reading 160-179/100-109 mmHg), or "defer" (≥1 reading ≥180/110 mmHg). The primary outcome was the proportion of patients experiencing post-HBOT systolic BP >180 mmHg.

Results:



Pre-existing hypertension was documented in 48% of patients. Mean post-HBOT systolic BP increase was +11.6 mmHg, with greater elevations in patients with known hypertension. Of 109 patients, 63 (58%) remained in "proceed" throughout, 38 (35%) reached "individualize", and 8 (7%) met "defer" criteria. The proportion experiencing post-HBOT systolic BP >180 mmHg increased stepwise across categories: “proceed” (7.9% [CI 3%-17%]), “individualize” (50.0% [CI 35%-65%]), “defer” (87.5% [CI 53%-98%]); test for trend p<0.001. No hypertensive emergencies were documented. The pre-treatment BP thresholds clearly separated risk groups within this cohort.

Conclusions: We propose a structured, evidence-based pathway for hypertension management in elective HBOT, with day-of-treatment thresholds aligned to international guidance, supported by stepwise risk separation in our retrospective cohort. As thresholds were developed and applied within the same cohort, prospective external validation is required. A prospective implementation and outcome-evaluation study is planned, pending ethics approval. These findings support development of broader international guidance on risk prediction and mitigation.

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EUBS2026-O.44

Pioneers of Hyperbaric Therapies: The Reality of Forlanini’s Chamber. An Important Contribution to History.

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Background and Aims: To describe the real Forlanini’s chamber as an important preliminary step in the history of Hyperbaric Medicine.

Methods: A true in site examination of the authentic chamber designed by Forlanini, including a detailed analysis of its characteristics and therapeutic capabilities.

Results: Certain images of early hyperbaric pioneers have become highly popular. These pressure vessels were primarily used by scientists, researchers, and physiologists, among whom Paul Bert has received the highest recognition. However, from a medical perspective, the pioneering role of true hyperbaric therapies should be attributed to *Carlo Forlani*ni, despite the fact that a widely circulated drawing of his chamber with a lady inside, has fostered a fanciful imaginary perception.

Carlo Forlanini was not a merely researcher but a clinical physician deeply interested in the treatment of respiratory diseases, particularly tuberculosis, seven decades before the achievement of Streptomycin.

In 1870, he commissioned his brother *Enrico*, an engineer, to construct a hyperbaric chamber for a medical facility in Milano, Italy. His goal was to induce a collapse of pulmonary caverns caused by tuberculosis. This attempt resulted in a remarkably advanced hyperbaric chamber of 2.5 meters in diameter, with two compartments, a vertical door, exceptionally large viewports, and sufficient space for 4 patients. This structure differs completely from the widely circulated drawing featured in many books of Hyperbaric Medicine.

Nevertheless, the therapeutic outcomes were not as satisfactory as expected and, years later, he designed a simpler physical alternative to collapse pulmonary caverns : the so called *Artificial pneumothorax*, also known as *Therapeutic pneumothorax*. This method was easier to implement and more efficient, leading to its widespread adoption.

Oxygen was not utilised in Forlanini’s chamber. Only the physical and pneumatic effect of pressure itself served as the sole therapeutic agent. Such kind of procedures are currently recognised in our *European Code of Good Practice* as HYPERBARIC THERAPIES.

Conclusions:

Carlo Forlanini was a true pioneer applying hyperbaric therapy with an exceptionally well-designed chamber constructed specifically for treating patients and diseases, rather than solely for research. He rightfully deserves a prominent position in the history of Hyperbaric Medicine.

Size and features of Forlanini's chamber of 1870.

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Poster Presentations

EUBS2026-P.01

A Unified Decompression Framework for Nitrox Diving

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Background and Aims: VVal-18 and VVal-79 are established decompression algorithms used for fixed PO_2 diving and air diving respectively. VVal-79 is also applicable to oxygen decompression with an additional parameter (saturation-desaturation ratio, SDR) used only while breathing oxygen [1, 2]. If VVal-18 is applied to air dives, most decompression times will be excessively long, while VVal-79 applied to constant PO_2 dives tends to yield too short decompression.

In this work we aim to devise a unified decompression framework (UDF), valid for all nitrox dives, with characteristics similar to VVal-18 and VVal-79 when applied to the relevant breathing gases. In particular, the algorithm we seek should be applicable to open circuit air dives, possibly with oxygen decompression, as well as closed circuit constant PO_2 dives.

Methods: Our algorithm UDF-Nitrox26 uses nine compartments with linear-exponential equations for inert gas uptake and elimination, similar to VVal-18 and VVal-79, including an SDR factor for gas elimination. The main novel feature is that the SDR factor applies only when the difference between compartment pressure and arterial blood inert gas pressure exceeds a given threshold. Also, inspired PO_2 exceeding 1.3 atm is treated as an inert gas.

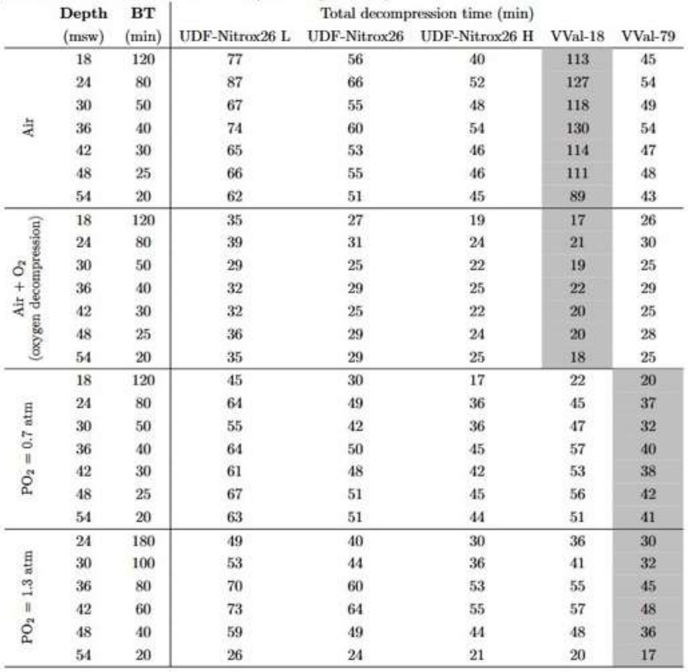
The compartmental maximum permissible tissue tensions (MPTT) at surface are the same as SWEN21B, designed for a 1% DCS risk for no-stop dives [3]. Four additional sets of MPTT parameters, denoted with the suffixes XLow, Low, High and XHigh, with lower and higher risk levels, are also provided.

Results:

The UDF-Nitrox26 algorithm produces decompression times similar to VVal-79 or SWEN21B for open-circuit air dives, including oxygen decompression, and similar to VVal-18 for closed-circuit constant PO_2 dives.

Table 1 shows examples of total decompression times for UDF-Nitrox26 variants compared to VVal-18 and VVal-79. Total decompression time is the total ascent and decompression stop time from bottom to surface. In most of these examples, the total decompression time for the relevant VVal algorithm lies between UDF-Nitrox26 and UDF-Nitrox26 High.

Table 1: Total decompression times for UDF-Nitrox26, VVal-18 and VVal-79. Shaded cells indicate that the algorithm is not intended for this gas mixture. "L" and "H" indicate low and high risk parameter sets. BT = bottom time (including descent).



	Depth	BT	Total decompression time (min)				
	(msw)	(min)	UDF-Nitrox26 L	UDF-Nitrox26	UDF-Nitrox26 H	VVal-18	VVal-79
Air	18	120	77	56	40	113	45
	24	80	87	66	52	127	54
	30	50	67	55	48	118	49
	36	40	74	60	54	130	54
	42	30	65	53	46	114	47
	48	25	66	55	46	111	48
	54	20	62	51	45	89	43
Air + O_2 (oxygen decompression)	18	120	35	27	19	17	26
	24	80	39	31	24	21	30
	30	50	29	25	22	19	25
	36	40	32	29	25	22	29
	42	30	32	25	22	20	25
	48	25	36	29	24	20	28
	54	20	35	29	25	18	25
PO_2 = 0.7 atm	18	120	45	30	17	22	20
	24	80	64	49	36	45	37
	30	50	55	42	36	47	32
	36	40	64	50	45	57	40
	42	30	61	48	42	53	38
	48	25	67	51	45	56	42
	54	20	63	51	44	51	41
PO_2 = 1.3 atm	24	180	49	40	30	36	30
	30	100	53	44	36	41	32
	36	80	70	60	53	55	45
	42	60	73	64	55	57	48
	48	40	59	49	44	48	36
	54	20	26	24	21	20	17

Conclusions: The UDF-Nitrox26 algorithm, or one of its variants, is a candidate for a unified decompression algorithm applicable to all nitrox dives. Validation diving of the algorithm is planned to take place later this year.

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Six Years of Fatal Diving Accidents: Insights From DAN Europe

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Background and Aims: Recreational diving is increasingly widespread. Despite growing attention to fitness-to-dive assessments and screening of pre-existing medical conditions prior to clearance, fatal diving accidents continue to occur. Although data from other regions are well described, comprehensive European epidemiology is still lacking. This study aims to analyse available data from DAN Europe case series.

Methods: A retrospective analysis of diving-related fatalities over a 6-year period (2020–2025) was conducted. Cases were evaluated based on available resources – accident, medical and police reports, and autopsy findings – across multiple variables, including demographic characteristics, medical history, dive profile, procedural factors, accident scenario, rescue and first aid, medical management, cause of death, potential role of diving equipment.

Results: Within the study period, 122 diving-related fatalities were reported. Most occurred in males (101), with the highest incidence in the 46–59 age group (56 cases) and a mean age at death of 54.5 years (range 32–79). The majority occurred in Europe (78), often in the diver's country of residence (59).

Where information on diving equipment was available (45), 24 accidents involved open-circuit systems and 21 closed-circuit rebreathers. Medical or autopsy reports were available in 50 cases. Where recorded (22), loss of consciousness occurred underwater (19), after surfacing (3). Death occurred underwater (9) or in hospital (8, including 2 following care withdrawals due to poor prognosis).

Of 40 autopsies conducted, there was evidence of single/multiple cardiac disease in 22 cases (ischemic heart disease 17, cardiomyopathy 14) and arterial gas embolism in 14 cases. The final cause of death was drowning in 20 cases. A possible role of faulty diving equipment was suggested in 7 of 10 cases where examination was reported.

Conclusions: Data completeness remains a significant limitation due to challenges in case retrieval, including remote locations, language barriers, institutional variability, and the sensitive nature of such events. Without comprehensive data, it was not possible to apply a root cause analysis, as recommended for a thorough assessment of the chain of events, to identify triggering factors and implement appropriate preventive strategies.

These findings highlight the need for a structured European database to improve understanding and prevention of diving-related fatalities.

EUBS2026-P.03

The Need for Standardized Dive Computer Verification and Validation to Improve Operational Capability

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Background and Aims: The ongoing transition from analog dive tables and open-circuit apparatuses to electronically controlled rebreathers and dive computers is resulting in a continuing need to evaluate and ensure the sufficiency of current standards [1]. In 2011, researchers examined the absence of validation methods for dive computers and decompression algorithms [2], however, this has yet to be addressed. As a result, many commercial divers, including military, continue to use analog tables. With sufficient standardization, dive computers could become a great tool in commercial and military diving, increasing the operational capability.

The aim of this study is to evaluate current standards, and their limitations, to identify areas that need to be addressed for continued development and implementation of diving equipment, with a particular focus om dive computers and decompression algorithms.

Methods: We perform a review of the European standard EN13319:2000 [3], *Depth Gauges and Combined Depth and Time Measuring Devices*, and EN14143:2013 [4], *Self-Contained Re-Breathing Diving Apparatus*, to identify and summarize sections that cover dive computers. Moreover, we perform simulations with Bühlmann ZHL16B to illustrate limitations of considered standards regarding oxygen partial pressure (PPO_2) setpoint control.

Results: EN13319:2000 primarily focuses on time and depth measurements, excluding decompression algorithms, as addressed in [2]. EN14143:2013 covers areas that apply to dive computers, such as PPO_2 levels and warning systems, but mainly focuses on the main components of a rebreather.

In Table 1, we present the difference in decompression time when using two examples of PPO_2 setpoints consistent with the accepted deviation at constant depth presented in EN14143:2013. While the result indicates a risk of insufficient decompression, given by the specifications of the standard, it does not represent a common practical case. However, it is a possible consequence if a dive computer is used separately from the rebreather.

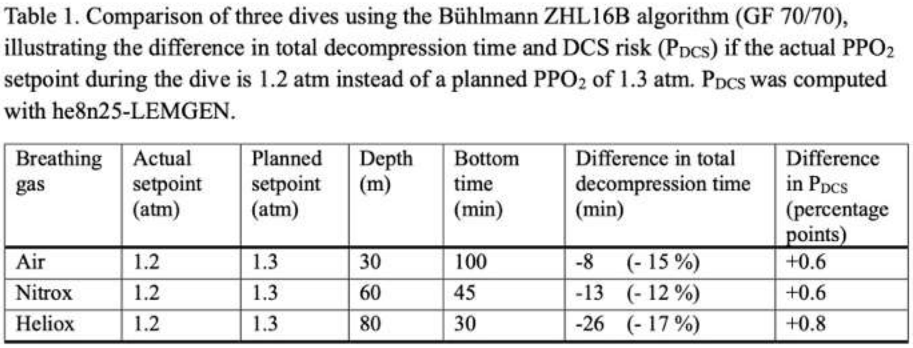

Table 1. Comparison of three dives using the Bühlmann ZHL16B algorithm (GF 70/70), illustrating the difference in total decompression time and DCS risk (P_{DCS}) if the actual PPO_2 setpoint during the dive is 1.2 atm instead of a planned PPO_2 of 1.3 atm. P_{DCS} was computed with he8n25-LEMGEN.

Breathing gas	Actual setpoint (atm)	Planned setpoint (atm)	Depth (m)	Bottom time (min)	Difference in total decompression time (min)	Difference in P_{DCS} (percentage points)
Air	1.2	1.3	30	100	-8 (- 15 %)	+0.6
Nitrox	1.2	1.3	60	45	-13 (- 12 %)	+0.6
Heliox	1.2	1.3	80	30	-26 (- 17 %)	+0.8

Conclusions: The considered standards do not cover decompression algorithms and are insufficient regarding the verification and validation of dive computers, illustrated in this study through a review of current standards and simulations. We stress the need to develop a standardized method to ensure the reliability of dive computers.

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EUBS2026-P.04

Long-Term Psychiatric Health in Fully Certified Occupational Divers: A Registry-Based Study From Norway

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Background and Aims: Occupational diving may expose divers to a range of psychosocial stressors, including occupational hazards, irregular working hours, solitary work and elevated risk of accidents. In this study, we assessed long-term mental health among occupational divers in terms of psychiatric diagnoses in specialised healthcare services for mood-, neurotic- and stress-related disorders.

Methods: In this registry-based study, the study population includes fully certified occupational divers who held occupational diving certificates (I, II, or III) in Norway between 1982 and 2011 (n = 3,355). The controls consisted of a sample from the general population (n = 9,020) matched on gender and birth month/year. Data on psychiatric diagnoses in specialised healthcare services for mental disorders during the period from 2009 to 2020 were collected from the Norwegian Patient Registry and linked to individual participants by their national ID number. Possible differences in psychiatric diagnosis for mood-, neurotic- and stress-related disorders were analysed by logistic regression with adjustment for possible confounding from key sociodemographic variables.

Results: We found no significant differences in psychiatric diagnoses between divers and controls. Overall, 9.2% of divers and 8.5% of controls had at least one diagnosis of F3 and/or F4, corresponding to an adjusted OR of 1.10 (95% CI 0.96,1.27). Compared with controls, divers had no statistically significant difference in the odds of mood disorders (5.1% vs 5.3%; adjusted OR 0.97, 95% CI 0.81–1.16). Divers showed higher odds of neurotic and stress-related disorders (5.7% vs 5.0%; adjusted OR 1.19, 95% CI 1.00–1.42), although this association did not reach statistical significance.

Conclusions: We did not observe any differences in the occurrence of long-term mood-, neurotic- and stress-related disorders between occupational divers and controls.

EUBS2026-P.05

Clinical Markers, Treatment Allocation, and Resolution Timelines in Freediving Pulmonary Squeeze: A Multi- Competition Analysis

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Background and Aims: Freediving induced pulmonary syndrome (FIPS) is an umbrella term that describes respiratory pathology after a breath hold dive. Subtypes range from transient fluid shifts in interstitial tissues to fulminant pulmonary edema and alveolar hemorrhage. While documented in elite depth competitions, standardized clinical criteria for management of FIPS (normobaric surface or underwater hyperbaric oxygen) remain variable, and data on the timeline of post-dive physiological recovery is limited. This study evaluated clinical variations based on treatment allocation and modeled the rate of post-dive clearance of markers of respiratory pathology.

Methods: Retrospective data from 133 competitive dives across elite freediving events (Vertical Blue, Blue Element, and CMAS World Championships, 2023–2025) were reviewed. Independent sample t-tests evaluated differences in post-dive SpO2 and lung ultrasound B-line counts between divers who received medical treatment and those who did not. Linear regression models were built using post-dive elapsed time to track the resolution rates of pulmonary markers.

Results: Medical treatment targeted 21 high-risk dives, while 112 required no intervention. The treated cohort demonstrated significantly lower post-dive oxygen saturation (96.2% ± 2.1% vs. 97.4% ± 1.8%; $p = 0.04$) and a significantly higher post-dive lung ultrasound B-line burden (1.54 ± 1.1 vs. 0.61 ± 0.4; $p = 0.01$), even after oxygen therapy. Linear regression of the treated cohort revealed a significant negative relationship between time elapsed and total B-line count (clearance rate of -0.42 B-lines/hour; $p = 0.04$), with the clearance model projecting return to baseline at approximately 3.5 hours post-dive. Post-dive SpO2 values trended positively toward baseline levels, though the linear relationship over the broader timeline was not statistically significant ($p = 0.18$).

Conclusions: Objective physiological indicators differ significantly between treated and untreated divers, statistically validating that competitive event medical teams tend to deploy interventions for individuals presenting with more severe edema and hypoxia. Furthermore, establishing a predictable linear clearance rate provides a clear clinical timeline for pulmonary recovery. Because the model predicts full resolution within 3.5 hours for standard presentations, the 3-to-4 hour post-dive window represents an assessment point to screen for persistent edema versus transient physiologic fluid shifts.

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Dietary Habit Modifications on Dive Days and Nutrition Awareness Among Certified Scuba Divers

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Background and Aims: Balanced nutrition is essential for sustained athletic performance. However, diving-specific guidance is largely limited to saturation diving, and evidence regarding recreational diving remains limited. This study aimed to evaluate the general and dive-day–specific dietary habits of certified SCUBA divers and their nutrition awareness.

Methods: This survey study was conducted online among 38 certified divers. Data are presented as n (%), mean ± standard deviation or median (interquartile range), as appropriate. Comparisons were performed using the Wilcoxon signed-rank test.

Results: The mean age was 43.2 ± 12.6 years; the majority were male (n=29, 76.3%), and the mean body mass index was 25.9 ± 3.47 kg/m². Most participants were diving instructors (n=28, 73.7%). The mean diving experience was 17.3 ± 11.2 years. Only six divers (15.8%) were actively following a diet. Half of the participants (n=19, 50%) reported using dietary supplements. All divers believed that nutrition is related to diving performance. Most participants reported consuming their last main meal 1–2 hours before diving (n=25, 65.8%), most commonly a balanced meal containing carbohydrates and protein (n=22, 57.9%). Regarding fluid intake before diving, the majority reported consuming 500 ml or more of water (n=22, 57.9%). Most divers reported consciously increasing water intake on dive days (n=24, 63.2%) and paying attention to fluid intake during surface intervals when performing repetitive dives (n=32, 84.2%). Only 14 divers (36.8%) stated that they definitely had sufficient knowledge regarding nutrition recommendations specific to divers. A large majority of participants expressed willingness to attend diver-specific nutrition training if available (n=33, 86.8%), and most believed that a nutrition guideline tailored specifically for divers should be developed (n=34, 89.5%).

Table 1. The Dietary Habits of Certified Divers

	General Dietary Habits	Dive-Day Dietary Habits	p-value
Number of Main Meals	2.2 (1)	2.4 (1)	0.127
3	14 (36.8%)	19 (50%)	
2	19 (50%)	16 (42.1%)	
1	5 (13.2%)	3 (7.9%)	
Number of Snacks	0.9 (1)	0.3 (0)	0.009
0	2 (5.3%)	26 (68.4%)	
1	17 (44.7%)	7 (18.4%)	
≥2	9 (23.7%)	5 (13.1%)	
Daily water intake (L)	2.050±0.753	2.64±0.914	<0.001

Conclusions: This study highlights that divers make semi-conscious modifications to their dietary habits on dive days. Although all divers reported that nutrition is related to diving performance, only 36.8% considered themselves to have sufficient knowledge on this topic. This finding suggests a need for reliable, accurate information on diving-specific nutritional practices.

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EUBS2026-P.07

Tissue Specific Gradient Factors as an Alternative to Asymmetric Gradient Factors.

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Background and Aims: With asymmetric gradient factors GF LOW determines the depth of the first stop and GF HIGH the overall duration of the decompression. In between the first stop and the surface, GF values are interpolated between LOW and HIGH. As the ascent progresses from deep to shallow, GF values increase.

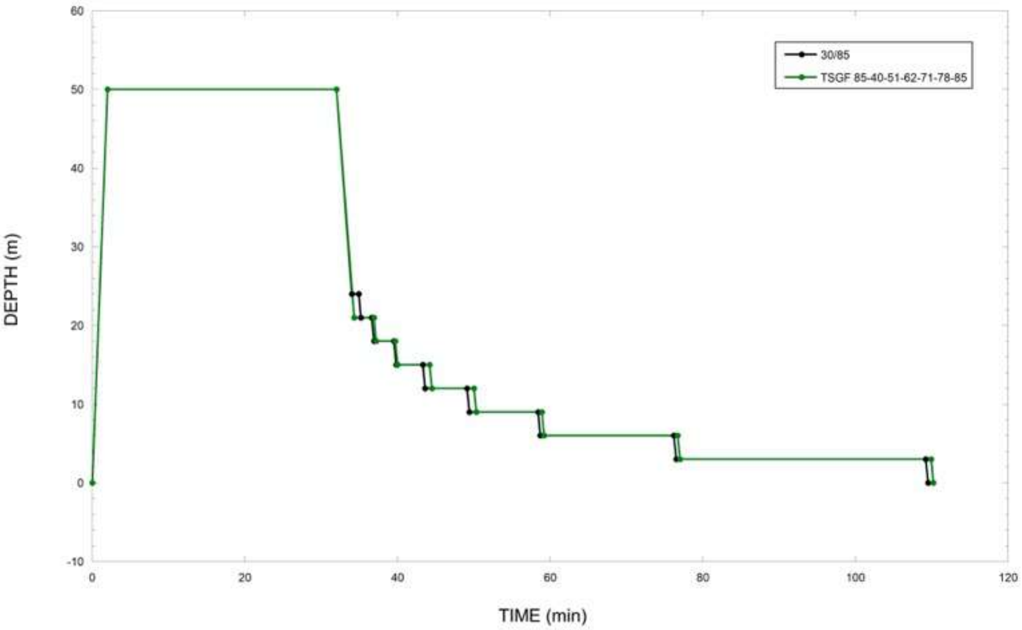
During any ascent, control of the algorithm is gradually shifted from tissues with shorter half times to tissues with longer half times. This means that GF is higher for tissues which tolerate less inert gas.

Methods: As an alternative method we assign fixed GF values for each tissue in a ZH-L16C algorithm. We call it TSGF, Tissue Specific Gradient Factors. For validation we found the combination needed to reproduce the results of a 50 m / 30 min dive using GF 30/85. The method can be applied also to reversed GF, such as 100/40. De Ridder et al found good agreement between GF 100/40 and the NEDU shallow stop profile calculated with VVal-18. We reproduce it with TSGF values equal to: 100-100-100-85-70-55-40-40…

Our idea is that GF values should decrease as control shifts to slower tissues. This automatically increases conservatism as the severity of the dive increases, also for repetitive dives with residual inert gas pushing the control further towards slow tissues.

We calculate the total decompression time for 30 m dives of increasing bottom time, repeated after a one hour surface interval, for 85/85, 70/70 and a TSGF set of 95-90-85-80-75-70-70…

Results: We show the result for a 50 m / 30 minute dive using GF 30/85, and with the following TSGF values. Tissue 1: 85, tissue 2: 40, tissue 3: 51, tissue 4: 62, tissue 5: 71, tissue 6: 78, tissues 7-16: 85.



Conclusions: Increasing GF values from fast to slow tissues seems counterintuitive. This might explain why asymmetric gradient factors are becoming less popular, in favor of symmetric values. But one could go a step further, assigning tissue specific values, where the same set can be applied from recreational dives (low PRT dives controlled by tissues 2-4) to very severe exposure (controlled by tissues 10 and higher).

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EUBS2026-P.08

Fast-Track Bronchial Provocation Testing Combining Treadmill Exercise and Cold-Air Breathing Using Standard Diving Apparatus

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Background and Aims:

Divers experience denser, colder and drier air than at the surface. Work of breathing increases. Saltwater micro-aspirations might occur, irritating airways [1]. Good lung function is crucial to maintain performance underwater. Free ascent may be associated with pulmonary barotrauma if hyperreactivity or asthma is present [1].

Minor spirometric deviations are common in asymptomatic military divers, raising concern about bronchial hyperreactivity or asthma [1].

Methods: We added cold, dry air to the standard test for exercise-induced asthma, as previously described [2,3], in order to make the test more provocative.We present a fast-track procedure for rapid diagnostics and functional evaluation of asymptomatic spirometric deviations, focusing on the fitness of military divers.

Results: Asymptomatic divers with reduced spirometric values showed no significant reduction (>10%) in FEV1 following triple provocation with exercise, cold, and dry air (Fig. 1).

Conclusions:

Cold, dry air is is a standard method [2,3] but seldom used in bronchial provocation testing, as it is technically demanding. By using standard diving equipment, including a demand valve, and a freezer, this type of provocation becomes easily available. The test is also more operationally relevant, as it is functional and demonstrates the diver's ability to tolerate high-intensity challenges under cold and dry air conditions.

The test may yield false positives, and positive results should be referred for further evaluation. For negative tests, we consider the provocation sufficiently rigorous, relevant, and potentially more sensitive; further referral is therefore not necessary. In some civilian settings, occupational and recreational divers may be permitted to dive if they are stable on treatment with inhaled steroids or long-term β2-agonists [1]. A demanding triple bronchial provocation test without significant reduction in FEV1 may objectively assess whether they are truly stable (unreactive) under diving-relevant conditions.

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EUBS2026-P.09

Type 2 Decompression Sickness and PFO: Successful Treatment, Percutaneous Closure, and Return to Diving

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Case description: A 24-year-old male completed 8 recreational dives over 4 days in Egypt within standard safety limits. However, severe dehydration and hyperthermia due to diarrhea from the first day coexisted, alongside high physical exertion and hyperventilation during his final dive. 18 hours after his last dive, he developed bilateral gonalgia, headache, and progressive limb paresthesia. At 32 hours post-dive, he boarded a commercial flight to Madrid, where his clinical status worsened, escalating to hand rigidity and spasticity during the flight, which established the definitive diagnosis of neurological Type 2 Decompression Sickness (DCS). Due to persistent symptoms upon landing, Hyperbaric Oxygen Therapy (HBOT) was initiated 6 days after his last dive, consisting of 4 daily sessions of 90 minutes at 2.2 ATA. Concurrently, urgent cranial CT, brain and cervical MRIs, and neurophysiological studies were performed, successfully ruling out segmentary spinal cord infarction. HBOT led to the complete clinical resolution of all symptoms. Subsequently, a transthoracic contrast echocardiogram with agitated saline revealed a prominent right-to-left interatrial shunt within the first 5 heartbeats at baseline and during the Valsalva maneuver, confirming a Patent Foramen Ovale (PFO). One month later, the patient underwent percutaneous transcatheter PFO closure and successfully returned to diving activities without further complications.

Conclusions: This case illustrates the critical role of PFO as an anatomical substrate for paradoxical bubble embolization, particularly in "undeserved" DCS where conservative dive profiles are strictly maintained. In alignment with the current Spanish cardiology consensus guidelines, any presentation of unexpectedly severe or neurological DCS warrants systematic screening for PFO using contrast-enhanced echocardiography. Once confirmed, clinical management must be tailored based on the specific shared decision-making framework outlined in the consensus. The three primary options include conservative diving modifications (e.g., restricting depth, avoiding multi-day profiles), permanent cessation of diving, or percutaneous PFO closure. As demonstrated in this case, transcatheter closure represents a highly effective intervention that directly mitigates the shunt-mediated embolic risk, offering a safe path for professional or passionate divers to successfully resume underwater activities.

EUBS2026-P.10

Scuba Diving Accidents in Tunisia: Epidemiology and Outcomes

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Background and Aims: In Tunisia, data on scuba diving accidents remain limited despite sustained professional diving activity along the coastline. This study aims to address this gap by analysing the clinical characteristics, risk factors, and prognostic outcomes of diving accidents managed at the hyperbaric medicine department of the Military Hospital of Tunis.

Methods: We conducted an observational, descriptive, and retrospective study from January 2010 to August 2025. One hundred and fifteen patients presenting with a diving-related accident were included. Diagnosis was established based on clinical and/or radiological criteria. Only cases of decompression sickness (DCS) were treated with hyperbaric oxygen therapy (HBOT).

Results: The study population was predominantly male (98.3%), with a mean age of 34 years. Decompression sickness accounted for 96% of the cases, of which 79% were Type II DCS, predominantly presenting with neurological manifestations (89%). The most frequently reported symptoms were sensory (63.5%), motor (49.5%), and vesicourethral (32%). Identified risk factors included medical history (hypertension, diabetes, patent foramen oval [PFO]), lifestyle factors (smoking), technical errors, and adverse environmental conditions (fatigue, cold). The mean time from symptom onset to therapeutic recompression was 35 hours (range: 1.5–360 hours). Patients received an average of 7.5 HBOT sessions (range: 2–17). The initial clinical outcome was favourable in the majority of cases.

Conclusions: Diving accidents primarily affect young professional divers exposed to largely preventable risks. The high frequency of severe neurological forms underscores the critical need for enhanced preventive measures and strict adherence to diving protocols (1). Reducing the delay to hyperbaric oxygen therapy, alongside structured medium- and long-term follow-up, is crucial for improving functional outcomes.

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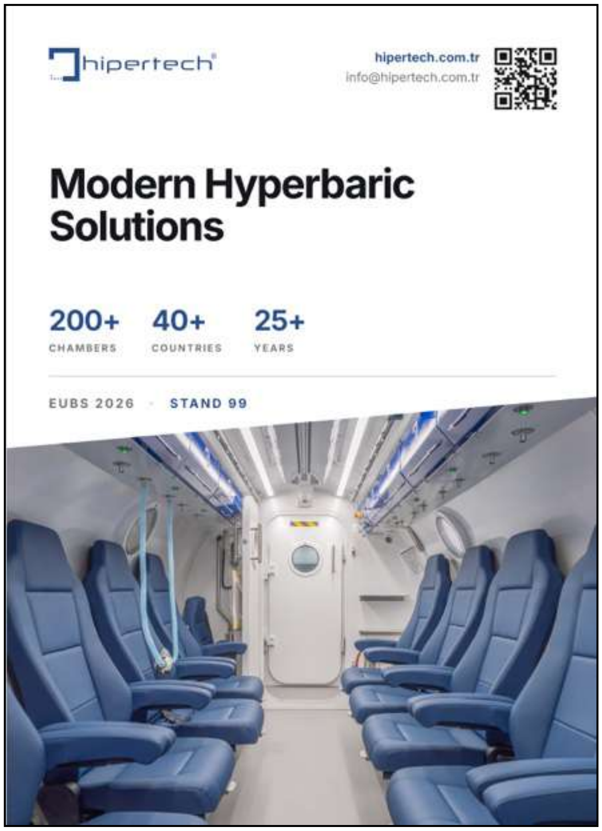

EUBS2026-P.11

Hunting High and Low – a Search for Blood and Urine Biomarkers in Divers

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Background and Aims: Divers show inter- and intra-individual variability in their response to otherwise comparable dive profiles (1). While some tolerate repeated dives without adverse effects, others may experience physiological stress or symptoms despite similar exposure. The mechanisms underlying these differences remain poorly understood.

During ascent, intravascular gas bubbles may form and contribute to decompression illness. Notably, bubbles can also be detected following dives with apparently safe decompression and without clinical symptoms. In such cases, platelet activation and alterations in platelet count have been reported (2), suggesting a physiological response to diving.

Proteomic-based technologies are used to detect diagnostic markers, alterations of expression patterns and understanding physiological mechanisms (3). Changes in the protein expression of blood platelets and plasma may provide information on individual and exposure-specific responses to diving. In addition, miRNAs - small, non-coding regulatory molecules, often encapsuled in extracellular vesicles, have shown promise as molecular biomarkers and may possibly reflect physiological stress and adaptation related to diving.

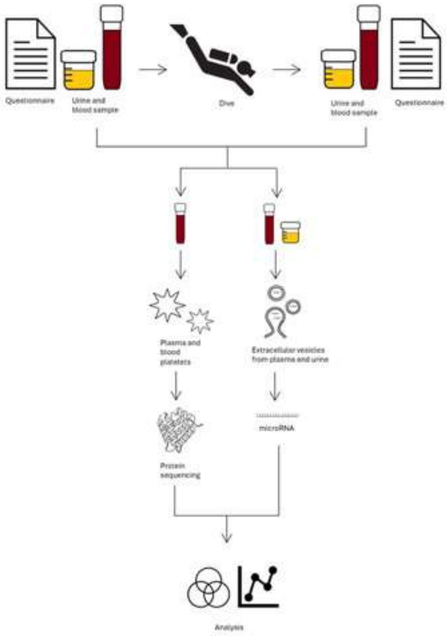
Methods: Blood and urine samples have been collected from diving students performing a range of controlled in-shore dives, with samples obtained in association with one or two dives per diver.

Planned analyses include protein sequencing of blood plasma and platelets, and miRNA profiling of plasma and urine. Additional samples from saturation divers will be included to explore responses to prolonged hyperbaric exposure.

Results: Samples have been collected from 17 divers, in association with one or two in-shore dives per diver. Four dive profiles were included: (i) inspection dives at shallow depths (12 msw ± 1) with long dive duration (98 ± 16 min); (ii) surface decompression dives to 30 msw (± 3), with a bottom time at 35 min followed by 30 min of surface decompression while breathing oxygen; (iii) single nitrox dives (36% O_2) to 22 msw (± 5) with a bottom time of 30 min; and (iv) repetitive nitrox dives to 20 msw, consisting of two 30-min dives separated by an approximately 15-min surface interval.

Conclusions:

The ongoing work aims to identify molecular signatures of individual diving responses. Integrating miRNA and proteomic data to reveal potential biomarkers may contribute to improved understanding of individual variability in diving adaptation.



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EUBS2026-P.12

The Effect of Smoking on Cardiac Stress Test Parameters in Professional Divers

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Background and Aims: Smoking is a major risk factor for cardiovascular disease and negatively affects physical performance (1). Evidence on the effects of smoking on cardiac performance in athletes is limited, and no published studies have focused specifically on professional divers (2). This study aimed to investigate the effects of cigarette consumption on cardiac performance in this population.

Methods: This retrospective study included professional divers who applied to the Department of Underwater Medicine and Hyperbaric Medicine at the SBU Gülhane Training and Research Hospital for fitness-to-dive examinations between January 1, 2017, and August 1, 2025. Participants were categorised into two groups: active smokers and non-smokers. The cardiac exercise stress test parameters were compared.

Results:

Conclusions: This study demonstrates that cigarette smoking in professional divers is primarily associated with an increased resting heart rate, while no marked effect was observed on exercise capacity or maximal exercise response. These findings suggest that early cardiovascular effects of smoking in young and otherwise healthy individuals may be detectable, particularly through alterations in autonomic balance and resting heart rate. Monitoring smoking behaviour and increasing awareness in sports involving high cardiovascular stress, such as diving, may contribute to the early identification of potential risks.

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EUBS2026-P.13

Patient Care After Diving Accidents in Emergency Departments in Germany: Data From the AKTIN Registry

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Background and Aims: Valid data are lacking on the frequency, severity, and management of diving accidents in Germany (1). Therefore, we do not know whether there is a need for specialized treatment centers for consultation and transfer of patients with severe diving accident.

The AKTIN emergency department (ED) registry constitutes standardized electronic infrastructure for data collection in patient care in the ED available for research. Presently, 99 ED are connected to AKTIN.

Methods: In accordance with the requirements for data usage, data for 3,768,397 patients (age >17 years) from 58 hospitals for the years 2022-2024 in AKTIN were further evaluated for diving (DIV-A) [ICD-10 diagnosis T70.0, T70.1 (Barotrauma), and T70.3 (Caisson disease, DCS/DCI)] or drowning accidents (DRW-A) (T75.1 Unspecified effects of drowning and nonfatal submersion) [project ID2025-010]. Patient characteristics and emergency codes were analyzed further.

Results: Data from 79 patients of 44 hospitals who suffered DIV-A (37.5 ± 15.4 years, male 61 %, Barotrauma 76%, DCI 24%) and for 83 after DRW-A (48.3 ± 22.8 years, 66%) could be evaluated. 27.8% of the DIV-A (92.4% of the DRW-A) patients had been allocated to hospitals through the EMS/HEMS ($P<0.001$). In addition, 24.7% (57.8%) of these patients were assigned to first assessment (MTS/ESI) categories 1-3 ($P<0.001$); 76% (14%) were treated on an outpatient basis; 20% (72%) were admitted to the hospital; 4.3% (3.9%) were transferred elsewhere; and 0% (8.7%) of patients died. Patients with barotrauma presented with significantly lower first assessment categories and continued as outpatients significantly more often than did those with DCI (89% vs. 43%) ($p<0.001$).

Conclusions: In Germany, diving accidents only make up a very small portion of patients presenting at ED. Numerous patients, do present secondarily on their own initiative. Only about 4% of them are currently transferred to another center and barotrauma patients can often be treated as outpatients. The low incidence could be the result of underestimating this rare condition and underscores the need for competent diving medicine centers 24/7 for consultations and treatment after diving accidents.

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EUBS2026-P.14

Heart Rate Variability Changes Associated With Wetsuit Hood Use in Dry Conditions: A Pilot Study

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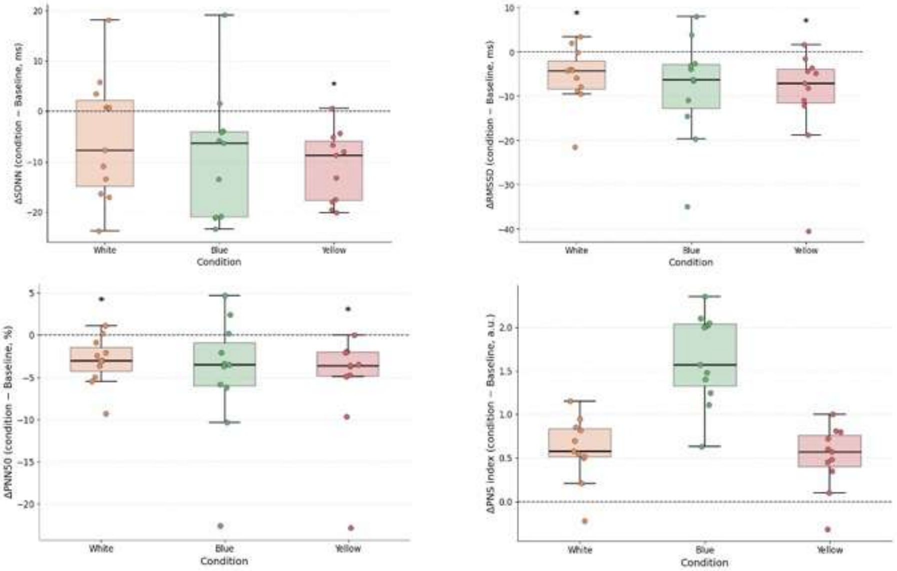
Background and Aims: This pilot study investigated whether wetsuit hood–induced cranial and cervical compression is associated with short-term autonomic changes assessed through heart rate variability (HRV) under controlled dry conditions.

Methods: Eleven healthy male military participants underwent HRV recordings during four fixed-sequence experimental conditions (Baseline, White, Blue, Yellow), corresponding to progressively increasing hood compression. RR intervals were recorded using a Polar H10 device and analyzed with Kubios HRV Premium using standardized artifact correction, generating normal-to-normal (NN) intervals. HRV parameters included SDNN, RMSSD, pNN50, and Kubios-derived parasympathetic (PNS) and sympathetic (SNS) indices. Mechanical compression was not directly measured; hood fit was explored indirectly using anthropometric proxies.

Results: Significant overall differences across conditions were observed for SDNN ($p = 0.036$), RMSSD ($p = 0.011$), pNN50 ($p = 0.004$), PNS index ($p = 0.034$), and SNS index ($p = 0.049$). Hooded conditions were associated with reductions in vagally mediated HRV indices, particularly RMSSD and pNN50, together with patterns suggestive of increased sympathetic modulation. Relative indices (%PNS/%SNS) did not significantly change. Considerable interindividual variability was observed. Exploratory analyses suggested that neck circumference, used as a proxy for hood fit, may influence autonomic responses. Continuous-strain exploratory analysis supported the presence of HRV changes but did not demonstrate a clear dose–response relationship.



Conclusions:
Under controlled dry laboratory conditions, wetsuit hood compression was associated with short-term changes in HRV-derived autonomic indices. These findings should be considered preliminary and hypothesis-generating. Further studies using randomized designs and direct pressure measurements are required to clarify the physiological mechanisms involved.

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EUBS2026-P.15

Understanding Decompression Risk Analysis: A Retrospective Study of "Undeserved" DCI Cases

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Background and Aims: The term "undeserved" is widely used in both scientific literature and diving community, yet a clear definition is lacking.Decompression Risk Analysis (DRA) is a structured, mathematical-based evaluation grounded in the Bühlmann ZH-L16C algorithm, integrating detailed dive profile data to enable a comprehensive assessment of a dive or a series of dives.This process is systematically applied to all suspected decompression illness (DCI) cases managed by DAN Europe Emergency Team. Cases are followed from the initial emergency phase, through treatment, and into follow-up - when electronic dive profiles are requested and, when provided, analysed by DAN Europe Research Department. This comprehensive approach aims to understand the mechanisms potentially underlying or contributing to each event, thereby supporting the refinement of preventive strategies and reducing the risk of recurrence.

Methods: A retrospective analysis of DRAs collected over a 12-month period (April 2025–March 2026) was conducted, including typical recreational dives performed within standard decompression limits and without evident procedural violations (e.g., uncontrolled ascent, omitted safety stops), resulting in confirmed DCI. Comprehensive information about dive and settings, DRA outcome, and key profile characteristics was evaluated.

Results: Of 77 DRAs reviewed, 44 cases were excluded (6 procedural errors, 12 incomplete data, 12 uncertain diagnoses). Even though the authors decided to also exclude technical diving (14), due to peculiar conditions, it is notable that all resulted in DCI within decompression algorithm limits and could as well be considered "undeserved".

The final cohort included 33 DCI cases – mostly cutaneous (10), inner ear (7) or neurologic (7) DCI –, following repetitive dives (27) breathing compressed air (24).

Based on objective calculation of end value, DRA outcome was found very high risk (1), high risk (23), medium risk (8). On a subsequent interpretation, the most frequent findings in profiles were rapid ascent (14), uncontrolled buoyancy (13), and short surface intervals (12).

Conclusions: Decompression algorithms inherently include a "gray area" in risk prediction— even within the boundaries of established decompression models. DRA proved to be a valuable post-incident tool, helping divers and physicians better understand decompression risk beyond algorithmic outputs and supporting personalized guidance for a safe return to diving.

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EUBS2026-P.16

Determination of Tidal Volume-Controlled Buoyancy Boundaries' Impact on Diver Workload Efficiency.

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Background and Aims:

Methods: The forces on divers using a hydraulic buoyancy control device were collected using Scubapro G2 dive computers (n= 23,000 dives by 1,572 divers). The ideal gas law (PV=nRT) is used to convert pressure data into both mass reduction as a result of breathing (slow and gradual pressure reduction over time) and water-fill/purge information (abrupt variations in SPG readings). The surface buoyancy of the diver was calculated using the divers' gear data and basic physiology.

Results: A representative dive profile shows the diver descending from 0M to 16M with no need for buoyancy adjustments with the force on the diver well within the boundaries of the tidal volume (mins 10 to 32). The tidal volume of the diver was estimated at 7ml/Kg-bodyweight. The need for buoyancy change (min 32) arises from an accumulated loss of ~1Kg of gas mass, but overall the SAC rate throughout the dive remained consistent. While the diver does not feel a difference, the recorded SAC rates show an increase up to twice the baseline while the diver is out of the zone. When the force on the diver is only 0.2-0.8 Kg-F outside the zone the observed increase in SAC rate is significant. With the addition of compressible volume these forces can evolve as a result of depth change to 5-6 Kg-F increasing workload substantially.

Conclusions: Ultra-stable neutral buoyancy in a dive can easily be controlled by tidal volume using the Avelo dive system regardless of depth change. When the vertical force on a diver is smaller than the undulating force resulting from normal breathing buoyancy control effort and diving efficiency will be optimal. Therefore, the tidal volume represents buoyancy boundaries within which air consumption can be optimized. This tool allows for a direct, quantitative field correlation of stable neutral buoyancy impact on workload.

EUBS2026-P.17

Post-Decompression Recovery in Commercial Saturation Diving: Pilot Data on Heart Rate Variability and Perceived Fatigue

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Background and Aims: Commercial saturation divers frequently report a period of low physical capacity and fatigue following return to surface pressure after decompression from hyperbaric saturation. The pilot data presented here form part of a broader study investigating recovery following saturation diving using wearable technology. The Firstbeat heart rate (HR) monitor records beat-to-beat R-R intervals (RRi), which enables HR monitoring of saturation divers before and after a saturation dive. Time-domain heart rate variability (HRV) indices like the standard deviation of all normal-to-normal RRi (SDNN) and the root mean square of successive differences of normal-to-normal RRi (RMSSD) are common HRV indicators calculated from such HR recordings.

Methods: RRi were recorded during sleep and throughout a series of standardized orthostatic tests. Measurements were conducted in the home environment, during travel for crew change and on board the diving support vessel (DSV) at multiple time points before saturation exposure and during the post-decompression recovery period. Perceived fatigue was assessed to complement the physiological data, using the Chalder Fatigue Scale and Fatigue Severity Scaling questionnaires [1, 2]. Data were transferred to NTNU and HRV analyses were performed with Kubios HRV Scientific 4.2.0. RRi were sampled over night followed by an orthostatic test in the morning, and through separate orthostatic tests. Orthostatic tests were conducted in the following manner:

The bladder was emptied and two timers were set for 5 and 10 minutes: 5-minute recording in supine position, then standing up for a 5-minute recording. Two segments of 4 minutes were used for HRV analyses from each 5 minute sequence. 3 hours sleep recording was extracted for HRV analysis.

Results: Time-domain HRV indices, shown here in Figure 1, by SDNN and RMSSD, were reduced after saturation diving compared to pre-sat baselines. Post-sat orthostatic HRV indices increased during the post-sat periode on the DSV.

Subjective reports on fatigue status reflected the HRV findings, with an increase in the perceived fatigue status after saturation.

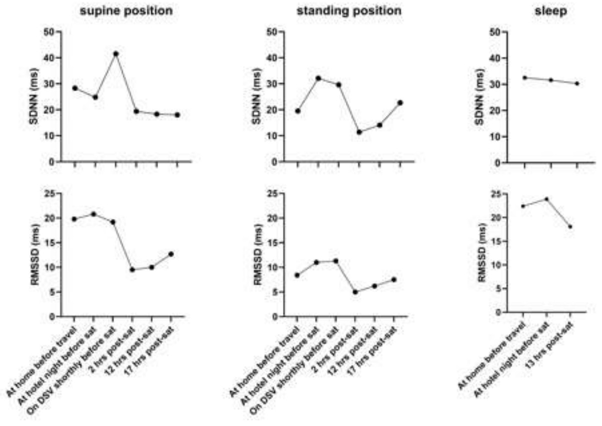

Figure 1. *HRV data from one volunteer showing a reduction in SDNN and RMSSD after saturation diving compared to pre-saturation baselines, measured during sleep, and in supine and standing position. Both indices increased during the initial hours after decompression.*

Conclusions: The HRV data and fatigue reports show that it is technically feasible and physiologically relevant to use wearables to monitor individual cardiovascular responses before and after saturation diving.

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EUBS2026-P.18

Clinical Outcomes of Hyperbaric Oxygen Therapy in Delayed Neuropsychiatric Sequelae Following Acute Carbon Monoxide Poisoning

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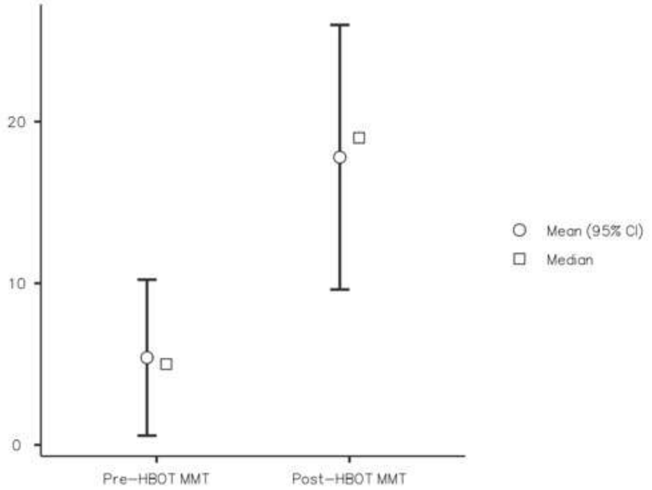
Background and Aims: Delayed neuropsychiatric sequelae (DNS) following acute carbon monoxide (CO) poisoning are characterised by delayed onset of neurological and psychiatric symptoms following an initial recovery period. Although 50–75% of patients demonstrate significant recovery within one year, a substantial proportion may develop persistent neuropsychiatric deficits. No standardised treatment has been established. Hyperbaric oxygen therapy (HBOT), due to its effects on hypoxic injury, oxidative stress, and inflammatory pathways, has been proposed as therapeutic option. This study aimed to evaluate outcomes of HBOT in patients with DNS following acute CO poisoning.

Methods: This retrospective study includes patients who underwent HBOT for DNS following acute CO poisoning at Gülhane Training and Research Hospital, between January 2017 and February 2026. Data were presented as median (interquartile range), and comparisons were performed using the Wilcoxon signed-rank test.

Results:



A total of 12 patients were included, with a median age of 59 years (IQR 16.8). Eight (66.7%) were male. The most common CO exposure source was stove (n=5, 45.5%). The median carboxyhemoglobin level at presentation was 19.5% (IQR 9.7). Neurological symptoms were present in nine patients (81.8%). Six patients (50%) were unconscious, and five (41.6%) were intubated. For acute CO poisoning, HBOT was administered only to six (50%) patients with a median of 3.5 (IQR 7.25) sessions. The remaining were treated with normobaric oxygen therapy. The median time from CO exposure to DNS onset was 14 days (IQR 13.5). Five patients assessed with Mini-Mental State Examination (MMSE), median scores improved from 5 (IQR 11) before HBOT to 19.8 (IQR 7.5) after HBOT (p=0.063). (Figure 1) The median total number of HBOT sessions for DNS was 24.5 (IQR 14.8). Complete recovery was observed in 6 patients (50%), partial improvement in 4 (32.8%), and limited recovery in 2 (16.7%).

Conclusions: In this study, HBOT was associated with favourable clinical outcomes, with half of the patients achieving complete recovery. These findings support previous reports suggesting that HBOT may enhance neurological recovery in DNS. Nevertheless, larger prospective controlled studies are required to confirm its efficacy.

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EUBS2026-P.19

Wound Assessment: Visual Analysis vs. Measurement Software

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Background and Aims: Patients with delayed wound healing require multidisciplinary, multi-site management. Visual assessment of a wound may vary considerably between clinicians, depending on level of expertise, clinical experience, and the measurement tools employed.

Tracking wound evolution across care episodes can be complex and prone to inter-observer error. To standardize and optimize clinical practice, the image-processing application Weasis® has been implemented at HUG, enabling precise calculation of wound dimensions and surface area.

Methods: A structured questionnaire was distributed by e-mail to 7,165 clinical staff at HUG.

Compare two photographs of the same wound (Photo A / Photo B) and identify the difference in wound bed surface area.

Estimate the percentage difference in surface area between the two photographs.

Results were benchmarked against objective measurements obtained with Weasis® image-processing software. One point was awarded per correct answer; individual scores were then averaged.

Results:

768 voluntary, anonymous respondents (11% of invited staff)

Overall mean score: 4.95 / 10 across all professions and experience levels

No significant difference between professional groups in wound surface appreciation

High intra-group variability observed in all categories — highlighting the inconsistency of unaided visual assessment

Conclusions: The results of this study demonstrate that dedicated measurement software provides objective added value in wound assessment and follow-up documentation. Unaided visual evaluation — even by experienced clinicians — shows significant intra-group variability and systematic underperformance, regardless of professional category. Standardized, software-assisted wound measurement should be considered as part of routine multidisciplinary wound care protocols.

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Cerebral Arterial Gas Embolism Following a Computerised Tomography-Guided Percutaneous Lung Biopsy: A Case Report

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Case description:
A 67-year-old male with a history of squamous cell carcinoma of the throat, ischaemic heart disease, peripheral vascular disease, and epilepsy underwent CT-guided percutaneous biopsy of a right upper lobe pulmonary nodule. During the procedure, he developed acute hypotension and reduced consciousness (GCS 12). Extended CT imaging revealed air within the left ventricle, aorta, and coronary arteries. The procedure was immediately abandoned. Subsequently, the patient developed dense left-sided hemiparesis and facial droop. A code stroke was activated; CT brain confirmed cerebral arterial gas embolism (CAGE), while ECG demonstrated anterior ST elevation with reciprocal inferior changes, consistent with concurrent coronary involvement.

Initial management included supine positioning and high-flow oxygen via a non-rebreather mask, followed by urgent transfer to intensive care and onward to a regional hyperbaric facility. Approximately three hours after symptom onset, the patient arrived with persistent neurological deficits but improved consciousness (GCS 15). He underwent hyperbaric oxygen therapy (HBOT) using US Navy Treatment Table 5 in a multiplace chamber, with progressive neurological improvement observed during treatment. A second session (KA18 table) was completed the following day. The patient achieved complete resolution of neurological deficits and was discharged at his pre-event baseline.

Conclusions:
CAGE is a rare but serious complication of CT-guided lung biopsy, with an incidence of 0.02–0.07%. Air entry into the pulmonary venous system can result in systemic embolisation, affecting cerebral and coronary circulations. Despite its rarity, associated morbidity can be severe, making it a critical non-diving indication for emergency HBOT.

This case highlights the importance of early recognition and rapid management of iatrogenic CAGE. The presence of simultaneous neurological and cardiac manifestations underscores the potential for multi-organ involvement. HBOT acts by reducing bubble size, accelerating inert gas elimination, improving tissue oxygenation, and mitigating inflammatory injury. Initiation within six hours is associated with improved outcomes; in this case, treatment within three hours likely contributed to full recovery. Clinicians performing percutaneous lung procedures should maintain a high index of suspicion for CAGE and be familiar with immediate management and referral pathways for HBOT.

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Hyperbaric Oxygen Therapy in Neuropsychiatric Disorders: Translational Mechanisms and Exploratory Quantitative Synthesis

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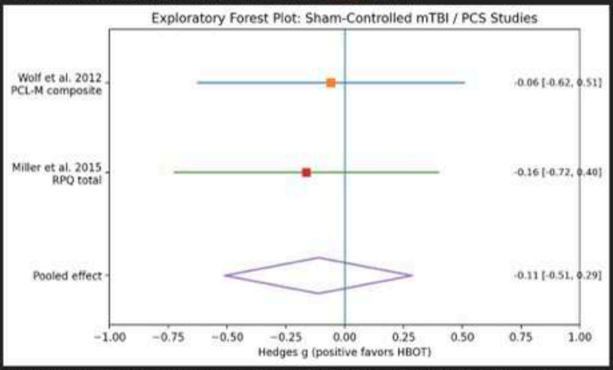
Background and Aims: Hyperbaric oxygen therapy (HBOT) has been proposed as a treatment for neurological and neuropsychiatric disorders characterized by impaired oxygen utilization, mitochondrial dysfunction, neuroinflammation, and reduced neuroplasticity. Mechanistic studies suggest HBOT may influence oxidative signaling, angiogenesis, mitochondrial bioenergetics, and inflammatory pathways. However, clinical evidence across neurological indications remains heterogeneous.

Methods:

This translational review integrated mechanistic evidence, clinical trial findings, and an exploratory quantitative synthesis of sham-controlled studies in persistent mild traumatic brain injury (mTBI) and post-concussion syndrome. Literature addressing neuroplasticity, neuroinflammation, and clinical outcomes in neurological HBOT applications was evaluated. Quantitative pooling was restricted to sham-controlled mTBI studies with directly extractable numeric data to reduce methodological heterogeneity. Standardized mean differences (Hedges g) were calculated and pooled using a random-effects inverse-variance model.

Figure 1. Exploratory Forest Plot (Sham-Controlled mTBI Studies)



Forest plot demonstrating pooled effect size showing no significant benefit of HBOT over sham.

Results: Mechanistic evidence supports HBOT-induced modulation of oxygen delivery, mitochondrial signaling, reactive oxygen species pathways, neurovascular remodeling, and inflammatory regulation. Imaging studies in chronic neurological conditions suggest potential activation of hypometabolic neural regions and neuroplastic changes. However, clinical outcomes remain inconsistent across randomized controlled trials.

Two sham-controlled persistent mTBI studies met criteria for quantitative inclusion. Individual effect estimates were centered near no treatment effect. The pooled exploratory estimate did not demonstrate superiority of HBOT over sham (Hedges g = -0.11; 95% CI: -0.51 to 0.29; $I^2 = 0\%$). Confidence intervals crossed zero, indicating no measurable symptom benefit within this restricted dataset.

Conclusions: HBOT is a biologically active intervention with plausible mechanisms relevant to neurological recovery, including modulation of neuroplasticity and neuroinflammation. Nevertheless, current sham-controlled evidence does not demonstrate consistent clinical benefit in persistent mTBI populations. The discrepancy between mechanistic plausibility and clinical outcomes highlights the urgent need for protocol standardization, biomarker-guided patient selection, and larger, multicenter randomized trials. Broader quantitative pooling across neuropsychiatric indications is currently limited by substantial heterogeneity in study design, comparator type, and outcome measurement.

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Endothelial Permeability in Human Endothelial Cells (HUVECs) Following Simulated Decompression Sickness.

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Background and Aims: Decompression sickness (DCS) is caused by the formation of gas bubbles during decompression. This initiates a complex cascade of biochemical, inflammatory and immune responses. Endothelial dysfunction is considered an important target of DCS injury. Endothelial cells play a role in homeostasis and vascular permeability. However, the contribution of endothelial permeability after sudden decompression is poorly characterized. The aim of the study is to evaluate this response with an in vitro human endothelial cell monolayer model (HUVECs).

Methods: For the present study, an in vitro model of Human Umbilical Vein Endothelial Cells (HUVECs) was used. They were cultured in ECM2 medium to form a monolayer; some cells were treated with TNF-α. The cells were exposed to a simulated rapid desaturation. Cellular permeability was measured using an In Vitro Vascular Permeability Assay with a fluorescent molecule (FITC-dextran). Fluorescence intensity was assessed by a fluorimeter at 6 hours and 24 hours after desaturation. Cell viability was evaluated using a colorimetric Lactate Dehydrogenase (LDH) assay kit to ensure that any observed increase in permeability is not artificially caused by cell death.

Results:

Conclusions: This study aimed to create a model of endothelial permeability characteristics after a rapid desaturation. These preliminary results have shown heterogeneous responses between decompression experiments. It needs additional experiments to improve reproducibility. This work may contribute to a better understanding of the cellular mechanisms involved in DCS pathophysiology.

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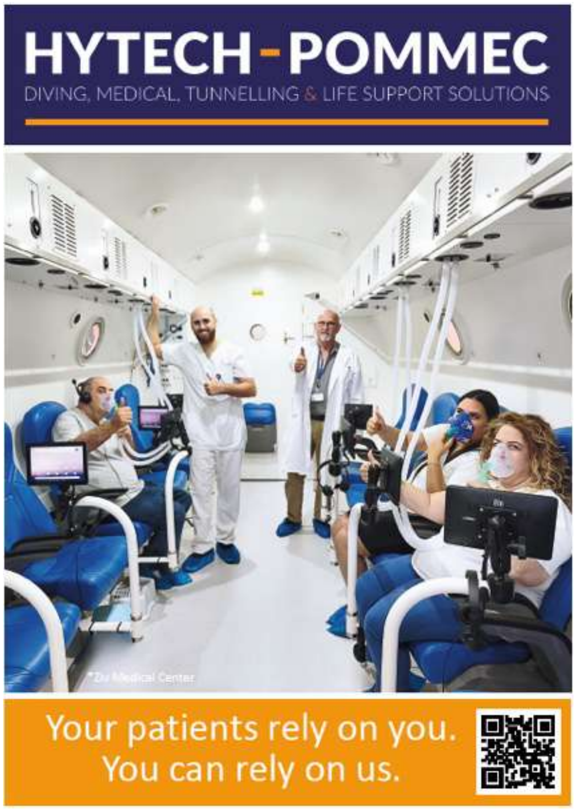

EUBS2026-P.23

A Rare Case of Fibrodysplasia Ossificans Progressiva and Complex Decision-Making Prior to Hyperbaric Oxygen Treatment

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Case description: A 52-year-old male presented for outpatient hyperbaric medicine consultation for radiation cystitis. He had a history of prostate cancer status-post 42.7 cGy of radiation to the pelvis two years prior. His presenting symptoms included microscopic hematuria, frequency, urgency, incontinence, dysuria, nocturia, and bladder pain. Cystoscopy showed diffuse erythema and bullous changes consistent with radiation cystitis. It was determined that hyperbaric oxygen therapy (HBOT) was indicated, but a further look into the patient's medical history revealed presence of a rare genetic disease: fibrodysplasia ossificans progressiva (FOP). This was concerning as supplemental oxygen is generally contraindicated in these patients as it may decrease the respiratory drive.[1]

A literature search revealed that this is an extremely rare (1 in 2,000,000) and progressive connective tissue disease whereby muscles, tendons, and ligaments ossify into bone tissue.[2] The condition is known colloquially as "stone man disease". Hallmark features include congenital hallux valgus of the large toes and episodes of painful soft tissue swelling that begin in childhood.[2] One of the most significant complications is Thoracic Insufficiency Syndrome (TIS) due to chest wall restriction caused by heterotopic bone growth in the ribcage, spine, and sternum.[3]

Our patient was noted to have FOP variant ACVR1 (c.982 G > C; Gly328Arg) mutation. Additional research and conversation with an endocrinology bone disease specialist revealed that this FOP variant is characterized by a milder clinical course and sparing of thoracic involvement. Our patient did not exhibit bony thoracic changes, and his PFTs were normal. The decision was made to proceed with HBOT.

Conclusions: Though there are few absolute contraindications to HBOT, there are several relative contraindications to consider before treating. While this patient initially appeared to present with a disqualifying medical condition, his specific presentation and clinical features allowed us to proceed with HBOT. This case highlights the importance of careful chart review, collaborative conversation with interdisciplinary colleagues, and individualized decision-making regarding benefits and risks when it comes to HBOT.

EUBS2026-P.24

The Effect of Hyperbaric Oxygen Therapy on Sleep Physiology

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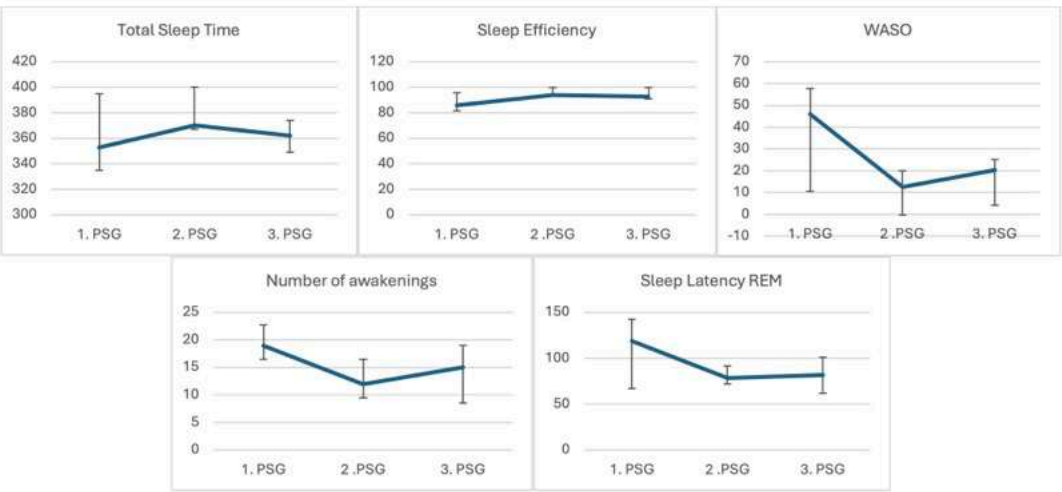
Background and Aims: Increased partial pressure of oxygen may influence central nervous system activity, circadian rhythm, and sleep architecture. However, studies objectively evaluating the effects of hyperbaric oxygen therapy (HBOT) on sleep physiology using polysomnography (PSG) are limited. This study aimed to evaluate the effects of HBOT on sleep parameters.

Methods: This prospective study is being conducted at SBU-Gulhane Training and Research Hospital. Patients aged 25–50 with an indication for HBOT were included. To ensure a standardized dataset by excluding hormonal fluctuations and menstrual cycle variations that could affect sleep architecture, only male patients were enrolled in the study. Individuals with known sleep disorders were excluded. PSG recordings were obtained before HBOT (PSG1), after the first session (PSG2), and after the fifth session (PSG3). Surveys were administered to patients before treatment and after the third PSG. Data were presented as median (interquartile range), and comparisons were performed using the Wilcoxon signed-rank test.

Results:

Eight male patients were evaluated in the preliminary analysis. The median age was 39 (14.3) years, and the BMI was 25.6 (4.4) kg/m². Significant increases in total sleep time and sleep efficiency, and a significant decrease in WASO were found between PSG1 and PSG3 (p=0.039, p=0.008, p=0.035, respectively). (Figure 1) The number of awakenings significantly decreased between PSG1 and PSG2 (p=0.028). REM latency significantly shortened between PSG1 and PSG3 (p=0.023). No significant changes were observed in other PSG parameters. While no significant differences were found in subjective scales, a downward trend was observed in the Epworth Sleepiness Scale and STAI scores.



Conclusions: These preliminary findings suggest that HBOT may improve sleep continuity and reduce sleep fragmentation. The increase in total sleep time and sleep efficiency, coupled with the decrease in WASO and the number of awakenings, indicates that HBOT holds potential for stabilizing sleep quality. The shortening of REM latency suggests a possible shift in sleep architecture organization. The clinical significance of these findings remains to be further clarified with larger sample sizes as the study progresses.

References:

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Oscillometry as a Feasible Lung Function Assessment Tool in Hyperbaric Patients: A Feasibility Study

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Background and Aims: Lung function assessment in hyperbaric medicine is rarely performed outside specialised pulmonary laboratories due to the need for trained personnel and complex equipment. Conventional spirometry, while effective, is often impractical in remote or austere environments. Oscillometry offers a promising alternative as a low-effort technique for evaluating respiratory mechanics by applying small pressure oscillations during normal breathing. It requires minimal patient cooperation and no formal training to operate, making it suitable for point-of-care use.

This feasibility study investigated whether an operator could reliably perform oscillometry without formal lung function training in a hyperbaric patient population, and whether the results were reproducible.

Methods: A prospective feasibility study was conducted at the Alfred Hyperbaric Unit over four weeks. Twelve patients undergoing routine hyperbaric oxygen therapy were consecutively recruited. Oscillometry was performed pre- and post-hyperbaric session using the Tremoflo C-100 by a single operator without formal lung function training. Primary outcome measures were respiratory system resistance and impedance. A valid test was defined as three acceptable measurements with a variability coefficient (VC) of less than 10%, consistent with established acceptability criteria for oscillometry.

Results: Ten of twelve patients (83%) successfully achieved a variability coefficient of less than 10% within six attempts, confirming acceptable reproducibility. In the remaining two patients, a valid test was not achieved after six attempts and testing was abandoned. Five patients had prior experience of formal lung function testing; all five reported oscillometry to be easier to perform.

Conclusions: This feasibility study demonstrates that oscillometry is reproducible and can be performed by an operator without formal lung function training in a hyperbaric patient population, supporting its potential as a point-of-care lung function monitoring tool. Its objective numerical output and minimal operator requirements make it well suited to detecting early pulmonary pathology in clinical hyperbaric practice. Future applications may include deployment in remote or austere environments, such as dive vessels or open water swimming events, for early detection of conditions such as immersion pulmonary oedema, though further research in those specific populations is required.

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EUBS2026-P.26

Hyperbaric Oxygen and Alprostadil for Complex PAOD in Multi-Morbidity: Case Analysis and Mechanistic Review

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Case description:

A 73-year-old female presented with chronic, non-healing ulcers on her bilateral 5th toes, cellulitis, and rest pain. Despite aggressive endovascular efforts, she exhibited Rutherford Grade 3 ischemia with wet gangrene. Her condition was further complicated by systemic burdens, including rheumatoid arthritis and chronic kidney disease.

Diagnostics revealed multi-segmental atherosclerosis. Angiography identified a 100% chronic total occlusion in the left posterior tibial artery. While angioplasty successfully reduced stenosis in the left anterior tibial and dorsal pedis arteries, the left plantar artery demonstrated persistent "slow flow".

To overcome this revascularization ceiling, the clinical team utilized an integrative treatment approach. This combined physical hyperoxia via Hyperbaric Oxygen Therapy (HBOT) with pharmacological vasodilation using Alprostadil. Alprostadil was specifically administered to dilate resistance vessels, improve erythrocyte deformability, and open channels to resolve the plantar artery's slow flow.

The patient was ultimately discharged stable with improved flow in the left ATA and DPA. This synergistic therapy, supported by a post-procedural regimen including NOAC and Pletaal, successfully bridged the micro-circulatory gap to prevent major amputation.

Conclusions:

This case demonstrates that combining systemic Hyperbaric Oxygen Therapy (HBOT) with Alprostadil provides a critical salvage pathway when surgical revascularization encounters an anatomical dead end, such as a 100% chronic total occlusion. By delivering dissolved oxygen directly via plasma and optimizing micro-vascular rheology, this synergistic approach effectively bridges the revascularization gap.

Key clinical lessons include:

- *Immediate Consultation:* Lesions staged as Wagner 3+ or Rutherford 4+ demand prompt HBOT consultation.
- *Mandatory Triage:* Patients with a baseline TcPO2 < 40 mmHg require an "Oxygen Challenge" to assess capillary bed viability. A response > 100 mmHg confirms an intact capillary bed, while a failure to rise indicates irreversible micro-thrombosis.
- *Multidisciplinary Integration:* Macro-vascular endovascular interventions must be supported by systemic oxygenation and a post-procedural pharmacological regimen of a NOAC and Cilostazol.

EUBS2026-P.27

Two Birds, One Chamber: HBOT in Infected Surgical Stumps and Chronic Cutaneous Graft-Versus-Host Disease

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Case description: A 54-year-old woman with a history of T-cell leukemia, in remission following an allogeneic hematopoietic stem cell transplantation four years prior, had established chronic cutaneous graft-versus-host disease (cGVHD) managed with tacrolimus, prednisolone, and extracorporeal photopheresis. In this setting of chronic immunosuppression, she developed septic shock secondary to *Escherichia coli* bacteraemia. The clinical course was complicated by vasopressor-induced peripheral ischemia, which resulted in dry gangrene of all toes, leading to surgical disarticulation at the level of demarcated necrosis. The patient was subsequently referred for hyperbaric oxygen therapy (HBOT) to enhance wound healing and support infection control. An initial protocol of 10 sessions at 2.5 atmospheres absolute (ATA) and 70 min O_2, was administered. Following this cycle, the surgical stumps demonstrated favourable evolution, with preserved suture integrity and resolution of local signs of infection. Notably, a concomitant cGVHD lesion on the forearm showed a marked reduction in surface area, decreasing from 17.6 cm² to 9.3 cm². Apart from HBOT, only simple daily dressing changes were carried out. Given this unexpected response, an additional 18 sessions were performed (total of 28 sessions). At final reassessment, all surgical wounds were fully epithelialized. Impressively, the cGVHD lesions on the forearm and dorsal hand achieved complete closure, associated with global improvement of cutaneous manifestations at other sites.

Conclusions: This case highlights the role of HBOT as an adjunctive therapy in complex post-surgical wounds in immunocompromised patients. Additionally, the observed response of cGVHD lesions suggests a potential immunomodulatory and pro-angiogenic effect of HBOT in this setting. These findings support further investigation through prospective controlled studies to assess HBOT as a therapeutic option for refractory cGVHD.

EUBS2026-P.28

Restoring Dignity: HBOT for Refractory Double Incontinence

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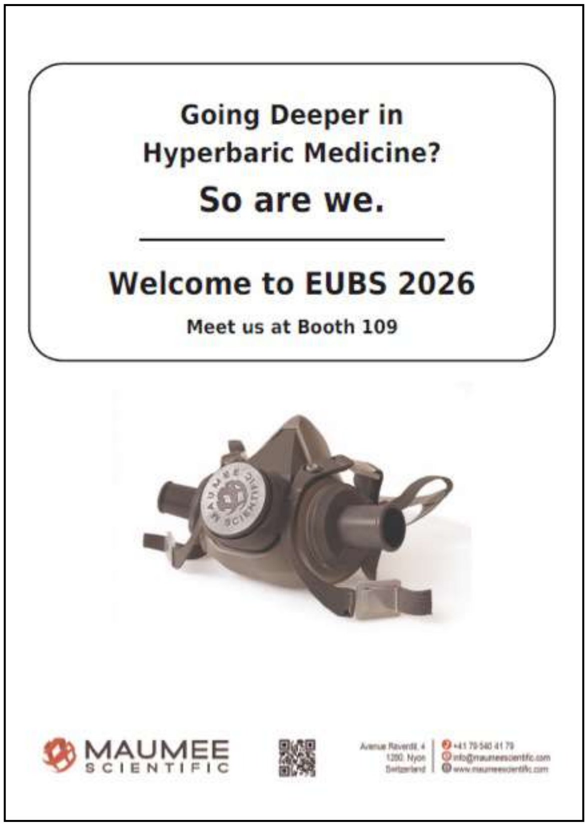
Case description: A 64-year-old female with type 2 diabetes and dyslipidaemia was referred for the management of urinary and faecal incontinence. Her oncological history included endometrial cancer diagnosed in 2015, treated with surgery, chemotherapy, and a combination of abdominopelvic radiotherapy and brachytherapy. Two years post-treatment, she developed total urinary and faecal incontinence associated with loose stools. Conservative management with pelvic floor rehabilitation failed to provide sustained benefit, and she was considered ineligible for sacral neuromodulation. The patient was referred to our hyperbaric unit in 2025, ten years after her cancer diagnosis and eight years after symptom onset. A diagnosis of late radiation tissue injury (LRTI), specifically non-haemorrhagic radiation cystitis and sphincter dysfunction, was established. A protocol of 30 sessions of Hyperbaric Oxygen Therapy (HBOT) at 2.5 ATA (70 minutes O_2) was prescribed, with more sessions prescribed based on the clinical response. Clinical improvement was noted from session 15 onward, and by session 50, the patient reported a 70% subjective recovery of sphincter competence. At session 70, although improvement had plateaued, the clinical gains were significant. The patient reported an 80% reduction in urinary loss volume compared to baseline. Faecal incontinence frequency decreased to approximately two episodes per month. Notably, the patient transitioned from requiring heavy daily incontinence briefs to using a single light security pad, representing a transformative improvement in quality of life.

Conclusions: This case demonstrates that HBOT can achieve clinically meaningful recovery in radiation-induced dual incontinence, even when initiated years after symptom onset and after conventional treatments have failed. These results support HBOT as a viable salvage therapy for LRTI affecting pelvic sphincter function.



EUBS2026-P.29

Design and Development of an Innovative Virtual Reality Training Platform for Hyperbaric Oxygen Therapy

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Background and Aims: Hyperbaric oxygen therapy (HBOT) demands specialized training to ensure patient safety and the effective operation of complex machinery. Traditional educational methods often lack the capacity for immersive, risk-free practice. This project aimed to design an innovative Virtual Reality (VR) training platform to enhance the pedagogical experience and clinical reasoning of hyperbaric medicine practitioners.

Methods: Methods:
The simulation platform was developed using a Scrum agile framework. High-fidelity 3D models of the hyperbaric chamber (HAUX-DECOMAT 4.0) were meticulously created using Blender (Figure 1). Unity XR Manager facilitated the VR integration, while Photon Networking enabled real-time multiplayer functionalities for collaborative group learning. A robust backend architecture (Spring Boot and PostgreSQL) was engineered to manage physiological states and interactive clinical scenarios.

Results: The platform delivers a highly realistic VR environment where trainees can safely manipulate hyperbaric controls (e.g., pressure levers) and manage simulated emergencies (Figure 2). Concurrently, instructors utilize a comprehensive dashboard to design interactive clinical cases, monitor trainee progress, and dynamically adjust patient vital signs in real-time (Figure 3). The integrated multiplayer capabilities successfully foster essential teamwork and communication within simulated clinical settings

Conclusions: This VR platform represents a significant pedagogical advancement in hyperbaric medical education. By providing a safe, highly immersive, and interactive collaborative environment, it effectively bridges the gap between theoretical knowledge and practical clinical competence, ultimately aiming to improve patient care outcomes.

EUBS2026-P.30

Frostbite, Hyperbaric Emergencies… and afterwards?

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Background and Aims: Frostbite is a hyperbaric emergency in which early management directly influences tissue and functional outcomes. Treatment combines hyperbaric oxygen therapy (HBOT), vasodilator therapy with Ilomedin®, and specialized nursing wound care. Although the acute phase is now relatively well standardized, post-HBOT follow-up remains heterogeneous, particularly after hospital discharge or when patients are managed by non-specialized healthcare professionals. The nursing role after hyperbaric treatment is based on regular wound assessment and adaptation of dressings according to the type and severity of the lesions. The objectives of local wound care are to prevent infection, maintain a moist environment favorable to healing, absorb exudates, reduce friction, and preserve stable tissue temperature. For dermal defects, management includes a 37°C antiseptic bath, removal of ruptured or compressive blisters, followed by greasy dressings combined with Ialugen® and thermal protection using Soft-Band® type bandages. In cases of dry necrosis, care involves meticulous cleansing, cautious debridement, antiseptic tulle dressings, and appropriate thermal protection. However, blister management remains debated, particularly regarding its potential impact on scintigraphic interpretation.

Methods: Personal experience and that of all the nurses at the Geneva hyperbaric center, in collaboration with the angiology and hand surgery department of Geneva University Hospital. The management of numerous patients with frostbite of varying stages has led to the development of a shared treatment strategy.

Results: The results of patient management for frostbite are described in the presentation :
1. Hyperbaric Oxygen Therapy with Iloprost Improves Digit Salvage in Severe Frostbite Compared to Iloprost Alone.
2. Successfully Delayed Hyperbaric Oxygen Therapy and Iloprost Treatment on Severe Frostbite at High Altitude.
The reduction in amputations is confirmed in the management of patients with hyperbaric oxygen therapy and iloprost.

Conclusions: The Cauchy classification helps assess lesion severity and guide follow-up. Given the variability of current practices, the implementation of an international multicenter protocol could standardize post-HBOT care, improve home follow-up, and facilitate collaboration between expert centers through shared guidelines, educational wound-care videos, and secure sharing of clinical data and photographs.

EUBS2026-P.31

Adjunctive Hyperbaric Oxygen Therapy in Severe Upper Limb Crush Injury: A Case Report

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Case description: We report a 43-year-old male who sustained a severe crush injury to the right upper limb following an industrial accident, resulting in a closed degloving injury (Morel-Lavallée lesion) with extensive soft tissue involvement. Initial presentation included significant motor deficit, sensory impairment in the distribution of the median, radial, and ulnar nerves below the elbow, and marked rhabdomyolysis (peak CK 8407 U/L).

The patient underwent multiple surgical interventions: hematoma drainage, serial debridements of non-viable soft tissues including extensive muscle debridement and prophylactic fasciotomies of the hand (dorsal and carpal tunnel release). Due to progressive tissue compromise, amputation of the third digit at the metacarpophalangeal level was required. Reconstruction with split-thickness skin grafts and a two-staged pedicled abdominal fasciocutaneous flap followed. The clinical course was further complicated by polymicrobial infection requiring targeted antibiotic therapy.

Adjunctive hyperbaric oxygen therapy (HBOT) was initiated early in the treatment course, with a total of 13 sessions performed. HBOT was used to enhance tissue oxygenation, support wound healing, and limit progression of ischemic and infected soft tissue. Despite the severity of the injury, the patient demonstrated progressive clinical improvement, with good viability of grafted and reconstructed areas, stable wound healing, and preservation of the limb. At follow-up, the patient remained under rehabilitation with favorable functional recovery.

Conclusions: This case highlights the potential role of HBOT as an adjunctive therapy in severe crush injuries with extensive soft tissue loss. In complex wounds associated with ischemia, infection, and repeated surgical interventions, HBOT may support tissue viability, enhance wound healing, and contribute to limb preservation. Multidisciplinary management remains essential for optimal outcomes.

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Hyperbaric Oxygen Therapy in Post-Traumatic Fournier's Gangrene: From Radical Debridement to Reconstructive

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Case description: We report a 24-year-old male admitted following severe polytrauma with hemorrhagic shock, who subsequently developed fulminant Fournier's gangrene. The clinical course progressed to mixed circulatory shock (hemorrhagic and septic) with multi-organ dysfunction and polymicrobial bloodstream infection, including fungemia.

Early surgical management was led by the Plastic and Reconstructive Surgery team, with serial radical debridements to achieve source control. Extensive soft tissue loss involved the scrotum, perineum, and infra-umbilical abdominal wall.

Adjunctive hyperbaric oxygen therapy (HBOT) at 2.5 ATA was initiated to address severe tissue hypoxia, with a total of 10 sessions performed. By increasing plasma-dissolved oxygen, HBOT may enhance leukocyte function, inhibit anaerobic growth, and promote angiogenesis, supporting wound healing in critically ill patients.

Following clinical and microbiological stabilization, definitive reconstruction was performed using local fasciocutaneous flaps for scrotal coverage and split-thickness skin grafts. Postoperative HBOT was continued as adjunctive therapy.

Outcomes demonstrated complete graft take and full flap viability, with restoration of anatomical integrity.

Conclusions: This case highlights the importance of early aggressive surgical debridement and multidisciplinary management in necrotizing infections following trauma. In the setting of severe hypoperfusion and fungemia, HBOT may serve as a valuable adjunct to improve tissue oxygenation and support reconstructive outcomes.

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Hyperbaric Oxygen Therapy and Diabetic Foot : Clinical Characteristics, Outcomes and Prognostic Factors

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Background and Aims: Hyperbaric oxygen therapy (HBOT) is proposed as an adjuvant treatment in complex forms of diabetic foot (DF). Its predictive factors for success remain insufficiently defined. Our objective was to describe the clinical characteristics and outcomes of patients treated with HBOT for DF and to identify prognostic factors associated with their outcomes.

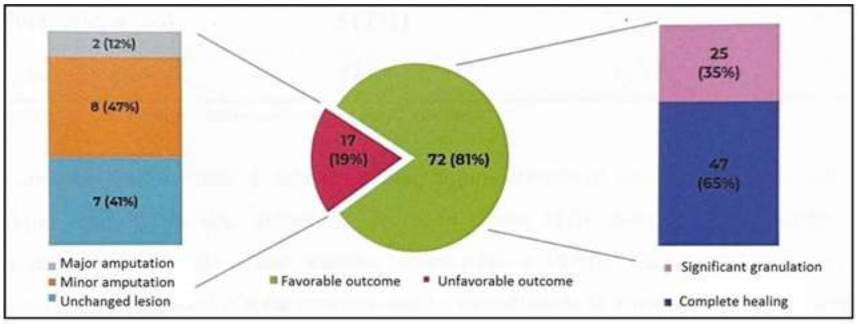
Methods: This was a retrospective and descriptive study including diabetic patients managed for DF in the HBOT unit of the Military Hospital of Tunis between January and November 2025. Epidemiological, clinical, paraclinical, and therapeutic data were analyzed. Outcomes were defined as favorable (healing or significant improvement) or unfavorable (no improvement or amputation). Univariate followed by multivariate analysis was performed to identify prognostic factors.

Results:

A total of 89 patients (65 men and 24 women), with an average age of 65.5 ± 10.6 years and an average duration of diabetes of 18 ± 8 years, were included.

The most frequent associated comorbidities were: hypertension (57%), smoking (72%), dyslipidemia (42%), coronary artery disease (21%), and peripheral arterial disease of the lower limbs (81%), with a history of revascularization in 19% of cases. Lesions were predominantly severe, with 77% classified as grade 3 or 4 according to Wagner.

The average number of HBOT sessions was 23 ± 14 [5–60]. Outcomes under HBOT were (fig1)



In multivariate analysis, ischemic heart disease (OR = 9.7), history of lower limb revascularization (OR = 8.1), and Wagner grade ≥ 4 (OR = 19.5) were independent predictors of poor outcome

Conclusions: HBOT appears to be associated with a favorable outcome in the majority of severe DF cases. However, the therapeutic response is strongly influenced by the initial severity of lesions and vascular comorbidities. Better patient selection could help optimize outcomes.

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A Feasiblity Study of Combined Hyperbaric Oxygen Therapy and Lifestyle Medicine Program for Multimorbid Conditions

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Background and Aims: Multimorbidity and polypharmacy are highly prevalent among patients receiving hyperbaric oxygen therapy (HBOT). Lifestyle Medicine (LM) interventions improve health outcomes in chronic disease management, but their implementation in tertiary hospital settings remains poorly studied and not at all in hyperbaric therapy.

Aims: To evaluate the feasibility and acceptability of delivering a Lifestyle Medicine Program (LMP) within a small hyperbaric medicine department and to generate methodological insights for future implementation.

Methods: A six-week, open-label, non-randomised feasibility study was conducted at the Department of Diving and Hyperbaric Medicine, Royal Hobart Hospital. The LMP comprised weekly group education sessions on the six pillars of LM, underpinned by motivational interviewing, and supported by newsletters. Acceptability (participant satisfaction ratings, recommendation rates, perceived value) and feasibility (enrolment, session attendance, retention, engagement, resource use, cost analysis, program delivery, and safety) were assessed via mixed methods data analysis on participant and staff feedback through questionnaires and focus groups.

Results: Twelve patients were recruited via rolling recruitment; 11 completed post-program questionnaires. Participants perceived the LMP as acceptable, safe, and valuable, with 11/11 recommending the program and 10 reporting it beneficial. Qualitative themes from short answers and focus groups described the group-based education fostered social connection and self-agency, though challenges in accessibility, program framing, and therapeutic alliance with HBOT highlighted areas for improvement to enhance feasibility and integration within clinical care. Seventeen staff completed their questionnaire, indicating that the LMP was perceived as beneficial, valuable, and achievable with the hyperbaric setting, provided that minor logistical and structural modifications are made.

Conclusions: Delivering a LMP alongside HBOT is feasible in a tertiary hospital setting, with potential to enhance patient wellbeing and complement clinical care. Larger, multi-site trials are needed to evaluate scalability, inclusivity, and long-term outcomes.

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Safety and Performance of Intravenous Pumps and Syringe Drivers in Hyperbaric Environments

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Background and Aims:
This study aims to critically evaluate the safety of intravenous (IV) infusion pumps and syringe drivers used in hyperbaric oxygen (HBO) environments, particularly for critically ill patients requiring precise medication delivery under pressure. The primary research question is whether existing portable electrically powered medical devices meet established safety and functional standards when operated in hyperbaric conditions. Specifically, the study examines compliance with key guidelines, including those from the Undersea and Hyperbaric Medicine Society (UHMS), NFPA 99 Health Care Facilities Code, NFPA 53, and Australian and New Zealand Standards 4774.2.
The innovative aspect of this research lies in its focus on integrating both functional performance and comprehensive safety risk assessment—areas historically evaluated in isolation. By systematically reviewing published safety data and comparing evaluation frameworks, the study addresses a critical gap: the lack of standardized, validated processes to ensure device reliability, fire safety, and operational accuracy in oxygen-enriched, pressurized environments.

Methods: A systematic literature review was undertaken to identify English language papers published in the last 15 years, describing the safety evaluations of IV pumps and/or syringe drivers for use in hyperbaric environments. Papers were critically assessed in relation to the requirements of international standards and safety recommendations.

Results: Eight studies of IV infusion devices were identified. There were deficiencies in the published safety evaluations of IV pumps for hyperbaric use. Despite a simple, published process for evaluating new devices, and available guidelines for fire safety, only two devices had comprehensive safety assessments. Most studies focused only on whether the device functioned normally under pressure and did not consider implosion/explosion risk, fire safety, toxicity, oxygen compatibility or risk of pressure damage.

Conclusions: Intravenous infusion (and other electrically powered) devices require comprehensive assessment before use under hyperbaric conditions. This would be enhanced by a publicly accessible database hosting the risk assessments. Facilities should conduct their own assessments specific to their environment and practices

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Salvaging Digital Ischemia After Dupuytren Surgery With Hyperbaric Oxygen Therapy

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Case description:
A 70-year-old male, former smoker (20 pack-years), with no relevant medical history, underwent ambulatory surgery for Dupuytren's contracture of the right fourth finger. The procedure was technically challenging due to extensive fibrotic involvement, without intraoperative vascular injury.

In the immediate postoperative period, progressive signs of digital ischemia developed. Initial management included aspirin, transdermal nitroglycerin, and axillary nerve block, without clinical improvement. Vasospasm was considered the most likely etiology.

On assessment, the digit was cold and ischemic distal to the metacarpophalangeal joint, with preserved radial pulses. Urgent hyperbaric oxygen therapy (HBOT) at 2.8 ATA was initiated. Marked improvement in perfusion and colour was observed during the first session, supporting continuation of treatment.

A total of 10 sessions were performed, with initial treatments at 2.8 ATA followed by 2.5 ATA. HBOT may improve tissue oxygenation, support microvascular perfusion, and help reverse ischemia in compromised digits.

By the tenth session, the patient demonstrated significant recovery, with normalization of colour, capillary refill, and sensitivity, except for mild residual hypoaesthesia of the distal phalanx. Photographic documentation confirmed substantial improvement in tissue viability.

Conclusions: This case highlights the potential role of HBOT as an adjunctive therapy in acute post-surgical digital ischemia, particularly when conventional vasoactive measures fail. Early initiation of HBOT may contribute to rapid restoration of perfusion and prevention of tissue loss. A structured treatment protocol resulted in near-complete functional recovery in this patient.

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Refractory Headache From Acute Pneumocephalus Treated With Hyperbaric Oxygen

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Case description:

A 22-year-old female was referred to the statewide hyperbaric service (HBS) for a refractory headache following a complicated epidural injection for chronic lower back pain. She initially underwent an outpatient CT-guided epidural injection at the L4/L5 level at a community radiology practice.

Approximately one hour post-procedure, upon sitting upright, she developed a sudden-onset headache radiating to the neck, associated with retro-orbital pressure. The symptoms persisted and were not relieved by lying supine. A CT brain performed 2.5 hours later demonstrated a large volume of extra-axial air along the right Sylvian fissure and within the ventricular system. She was transferred to a metropolitan emergency department for neurological assessment and subsequently referred to the HBS.

On arrival, she reported right thigh paraesthesia, with examination confirming reduced light touch sensation. No other focal neurological deficits were identified. Initial medical management with intravenous prochlorperazine and ketorolac failed to improve symptoms after one hour, and she was consented for hyperbaric oxygen therapy (HBOT).

A U.S. Navy Treatment Table 5 was administered, omitting the first air break. Treatment was initially limited by claustrophobia, which improved after switching from a hood to a mask delivery system. After 30 minutes of 100% oxygen at 180 kPa, her headache and paraesthesia completely resolved. She completed the session without further complications and was observed overnight in the short stay unit.

A repeat CT brain the next morning demonstrated a marked reduction and redistribution of extra-axial gas. The patient remained asymptomatic and declined further HBOT.

Four days later, she re-presented with an orthostatic headache, successfully treated with an epidural blood patch. A follow-up CT brain at three months confirmed complete resolution of the pneumocephalus.

Conclusions:

This case describes the use of HBOT in acute pneumocephalus, a rare complication of lumbar epidural injection that may be under-recognised in the absence of cerebral imaging. While many cases of pneumocephalus with varying aetiologies are managed conservatively, HBOT may accelerate resolution when symptoms are severe or persistent. Further research is needed to clarify its role, optimal timing, and implications for resource allocation.

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Enhancing Safety Culture and Clinical Competency in Monoplace Hyperbaric Practice

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Background and Aims: The increasing use of monoplace hyperbaric chambers in clinical practice has introduced unique challenges related to patient safety, risk management and clinical decision-making under constrained environments. While fundamental principles of hyperbaric medicine remain consistent across chamber types, significant differences exist in operational procedures, emergency response capabilities and human factors, particularly in oxygen-filled systems.
Objective: To explore how safety culture and clinical competency can be strengthened in monoplace hyperbaric settings through integrated approaches combining training, standardization and interprofessional collaboration.

Methods: A narrative synthesis of current European recommendations, safety frameworks and educational models in hyperbaric medicine was conducted, focusing on monoplace chamber practice. Emphasis was placed on recent updates in safety standards, competency-based training and risk assessment strategies.

Results: Recent European guidance highlights that core safety principles, staff training and clinical governance should be uniformly applied across monoplace and multiplace facilities, despite technical differences. The absence of unified regulatory frameworks specifically for monoplace chambers necessitates structured local risk assessment and standardized operational protocols. Contemporary models emphasize competency-based education for nurses, operators and technicians, continuous professional development and the establishment of dedicated safety roles within hyperbaric units. Additionally, human factors, communication and interprofessional coordination are increasingly recognized as critical determinants of safe practice.

Conclusions: Enhancing safety in monoplace hyperbaric medicine requires a shift from protocol-based practice to a systems-oriented approach integrating clinical expertise, technical knowledge and safety culture. Structured training pathways, harmonized standards and interdisciplinary collaboration are essential to optimize patient outcomes and minimize risk in high-consequence environments.

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Hyperbaric Oxygen Therapy as Redox-Driven Strategy in Chronic Wound Management

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Background and Aims: Chronic wounds are sustained by hypoxia, mitochondrial dysfunction, and persistent inflammation, all linked to redox imbalance. While reactive oxygen species (ROS) are traditionally considered harmful, controlled ROS levels act as key regulators of angiogenesis, immune response, and tissue repair. Hyperbaric oxygen therapy (HBOT) may act as a systemic modulator of redox signalling, shifting from oxygen delivery toward systemic biological regulation.

Methods: A retrospective real-world cohort analysis was conducted on patients with chronic wounds (diabetic foot ulcers, post-surgical wounds, and vascular ulcers) treated with standard care plus HBOT. Clinical outcomes (healing rate, infection control, time to granulation) were evaluated alongside a mechanistic interpretation based on redox modulation and mitochondrial function.

Results: HBOT was associated with accelerated wound healing, earlier granulation tissue formation, and improved infection control compared to expected standard care trajectories. Clinically, wounds with signs of chronic inflammation and biofilm showed the greatest benefit. Mechanistically, repeated HBOT sessions induced transient increases in ROS, activating redox-sensitive pathways (HIF-1α, VEGF, and Nrf2) and enhancing angiogenesis, stem/progenitor cell mobilization, and immune efficiency.
Over treatment cycles (30 sessions; 2.5 ATA; 90 minutes per session), a shift toward improved mitochondrial function and reduced oxidative stress, consistent with a hormetic response. These effects parallel the concept of *gentle oxidative debridement*, as described in the International Wound Infection Institute (IWII) Consensus Document 2025 on wound cleansing, where controlled oxidative stress disrupts biofilm and restores physiological healing without additional tissue damage.

Conclusions: HBOT demonstrates clinically relevant benefits in chronic wound management through modulation of redox biology rather than simple oxygen supplementation. Real-world data support its role in restoring the balance between oxidative stress and repair mechanisms. Positioning HBOT within the framework of controlled oxidative therapies may improve patient selection and optimize treatment protocols.

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Hyperbaric Oxygen Therapy in Treatment of Sickle Cell Vaso-Occlusive Crises: A Series of 39 Cases

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Background and Aims: Sickle cell disease is the most common genetic disease worldwide. Its incidence is particularly high in Mayotte, where a cohort of approximately 500 patients is being followed. Vaso-occlusive crises (VOC) are frequent and potentially serious acute complications of this disease.

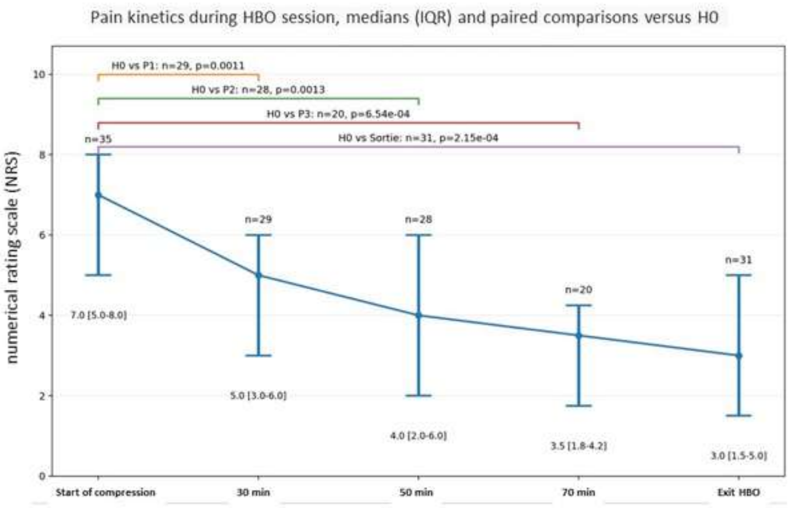
A single amino acid substitution in hemoglobin S (HbS) promotes polymerization in the deoxygenated state. This results in red blood cell sickling, reduced deformability, and microvascular obstruction, thereby triggering vaso-occlusive crises. Several physiological effects of hyperbaric oxygen therapy (HBO) could theoretically counteract the pathophysiological mechanisms involved in VOC.(1) In addition, HbS polymerization is a reversible process; HBO could help restore red blood cell shape and deformability by improving oxygenation.(2)

Methods: In this retrospective study, we describe a series of 39 VOC treated in the hyperbaric chamber of Mayotte. The protocol consisted of a 90-minute session at 2.5 ATA, with three air breaks.

The evolution of pain during the session was assessed using the numerical rating scale (NRS).

Results:

Eight patients prematurely ended the session due to earaches or anxiety. A patient who had received high doses of morphine and Nefopam experienced a CNS oxygen toxicity seizure that resolved spontaneously without any sequelae. Among the 30 patients who completed the HBO session, pain scores decreased significantly over the course of the session (Figure 1), consistent with the few clinical series already published (3).



Conclusions: This study suggests that HBO could improve short-term pain intensity in patients with major sickle cell disease hospitalized for refractory hyperalgesic VOC. A randomized controlled trial is currently being prepared to evaluate this therapeutic approach.

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Hyperbaric Oxygen Therapy (HBOT) in Acute Acoustic Trauma – Review of Literature

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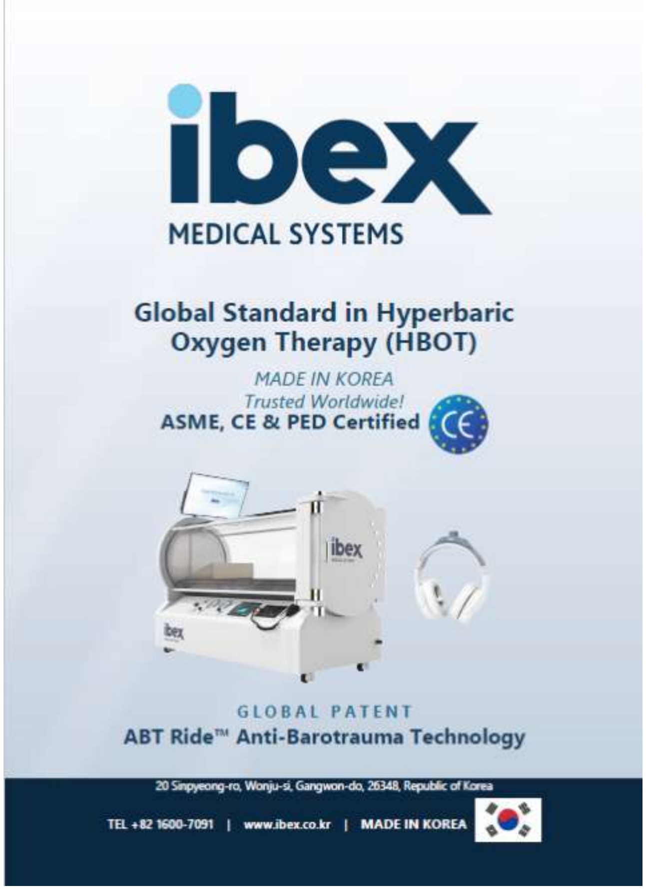
Background and Aims: Noise-induced hearing loss is a potentially irreversible sensorineural hearing loss. It results from the destruction of inner ear hair cells, caused either by prolonged chronic noise exposure or by acute acoustic trauma (AAT) due to high-intensity impulsive noise.

Methods: From 2010 to 2025, a bibliographic screening from PubMed, Embase, and Cochrane database. Retained 27 articles, mainly including retrospective studies. They were read by three readers and recommendations were defined by consensus protocol and Evidence Based Medicin status.

Results: Impulsive sound waves: mechanical cochlear effects, endocochlear oedema, synaptic excitotoxicity , metabolic stress, hypoxia, vascular impairments combined with an oxidative stress and inflammatory responses. HBOT can answer to a major parts of theses deleterious mechanisms.
Studies reporting overall audiometric improvement under HBOT with a mean gain of 15 decibels (dB) for the pure-tone average (PTA) and 20 dB for the high-frequency PTA (HPTA).
The most common HBO protocol is based at least over 10 sessions 2,2 to 2,5 ATA 2,5. Most benefit is observed when HBOT was early starting, during the first week after the exposure and for patients covering by corticosteroids.

Conclusions: Despite a low EBM level (C), HBOT can have a significant action in AAT. Prospectives studies are needed to validate its true place.



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Management of Carbon Monoxide Poisoning With Hyperbaric Oxygen Therapy : A Retrospective Study

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Background and Aims: Carbon monoxide (CO) poisoning is a frequent medical emergency, particularly during the winter season. In Tunisia, data on management using hyperbaric oxygen therapy (HBOT) remain limited. This study aims to analyze the clinical characteristics, sources of exposure, and therapeutic management of patients treated in the hyperbaric medicine department of the Military Hospital of Tunis.

Methods: An observational, descriptive, retrospective study conducted from November 2024 to January 2025. Two hundred and thirty-eight patients with acute CO poisoning were included, excluding infants under six months of age, butane poisoning cases, and patients with intolerance to HBOT. Data were collected from referral letters and clinical, biological, and radiological examinations.

Results: The population was predominantly female (66%), with an average age of 28 years. Cases occurred mainly in January (55%) and during weekends (44%). Water heaters were the most frequent source of intoxication (63%). Acute impairment of consciousness was the leading indication for initiation of hyperbaric oxygen therapy (62%). Biological abnormalities were observed, including elevated troponin levels (8%) and creatine phosphokinase (CPK) (10%). The average time to treatment was 255 minutes.

Conclusions: CO poisoning affects a young population, often exposed to preventable domestic sources. Rapid management with HBOT improves prognosis. Prevention and awareness regarding the safe use of heating devices remain essential.

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Effects of Hyperbaric Oxygen on Subdural Effusion: 3 Cases Report

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Case descriptions:

Case 1: The patient, a 57-year-old male, was admitted for hyperbaric oxygen therapy (HBOT) two months after undergoing craniotomy for decompressive craniectomy due to traumatic brain injury. At admission, the patient was in an open-eyed coma with left-sided hemiplegia. Cranial CT revealed extensive subdural effusion in the left frontal, temporal, and parietal regions, with mild left deviation of midline structures. To promote neurological recovery, the patient received HBOT (protocol: 2.0 ATA, 60 minutes of oxygen inhalation, once daily, five times weekly) for four sessions. After treatment, the patient exhibited reduced open-eyed time and somnolence. Follow-up cranial CT demonstrated significant expansion of the left subdural effusion, midline shift, and aggravated cerebral compression. HBOT was immediately discontinued, and the patient underwent "subdural effusion drainage." Two weeks later, follow-up CT showed marked reduction in effusion volume, and the patient's consciousness returned to pre-treatment levels.

Case 2: The patient, a 52-year-old male, was admitted to the hospital 14 days after a car accident resulting in splenic rupture, multiple fractures of the lumbar vertebrae and pelvis, and postoperative complications including cardiac and respiratory arrest leading to ischemic-hypoxic encephalopathy. Physical examination upon admission revealed: open-eyed coma, pain-induced limb flexion, normal muscle tone in all extremities, muscle strength grade 1, and bilateral Babinski signs (-). Pre-hypobaric oxygen therapy CT showed minimal subdural effusion in the right frontal region. After 7 sessions of hypobaric oxygen therapy (protocol: 2.0 ATA, once daily, 5 times weekly), the patient exhibited reduced open-eyed duration. Follow-up CT demonstrated significant bilateral frontal subdural effusion with midline shift to the left. Hypobaric oxygen therapy was immediately discontinued, and the patient underwent "right subdural effusion drainage" along with symptomatic supportive treatment. One month later, the subdural effusion (SDE) was essentially absorbed.

Conclusions: HBOT may exacerbate subdural effusion (SDE). For patients with SDE, HBOT should be administered with caution, and the risk-benefit ratio should be strictly evaluated. SDE should be considered a clinical condition requiring close monitoring.

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Mild Burn Treated With Hyperbaric Oxygen Sessions: A Case Report

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Introduction: Burns can be a critical illness with a complex work-up. The Undersea and Hyperbaric Medical Society (UHMS) and the European Committee for Hyperbaric Medicine (ECHM) recommend hyperbaric oxygen treatment (HBOT) for II-degree burns of plus than 20% body surface area (BSA). We suggest that the most benefit is obtained in severe scald burn patients (>20% BSA), with a large proportion of partial-thickness burns. HBOT should be initiated within six hours after the burn injury, and two sessions per day (at 253 kPa, 100% oxygen) should be given for a minimum of three days.

Case report: Patient is a 21-year-old male with no other comorbidities. The burn BSA involved about 3% with a minimal dermal exposure.

He was taken to the sickbay, where he was referring pain localized in the burn area. In a first evaluation, his respiratory rate was normal. Vital parameters were normal (PA 120/70 mmHg, HR 70 bpm, SatO2 97%).

The first approach was to clean the burn and start treatment with silver sulfadiazine cream once a day. We performed an HBOT regimen as described in the Italian Navy Manual.

After every HBOT session burn was medicated with saline solution to clean from debris and covered with silver sulfadiazine cream. Daily photos were shot in order to measure the extension during the treatment. The extension was blinded measure with ImageJ software by three authors in order to obtain an unbiased evaluation.

Discussion: The possibility of performing HBOT even with a very low extension of the burn pushes us to treat the patient to improve wound healing time and scar quality. The extension data obtained show a rapid healing with a significant reduction of the area between day one and day three. These evidences support the importance of HBO therapy in burn injury, even with a low BSA extension.

Conclusions: Hyperbaric Oxygen Treatment was performed in a young adult with a very low extension of the burn, to fast healing and improve the scar quality.

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Integrated Metabolomic and Transcriptomic Analyses Reveal Hyperbaric Oxygen Restores Mitochondrial Function After Spinal Cord Injury

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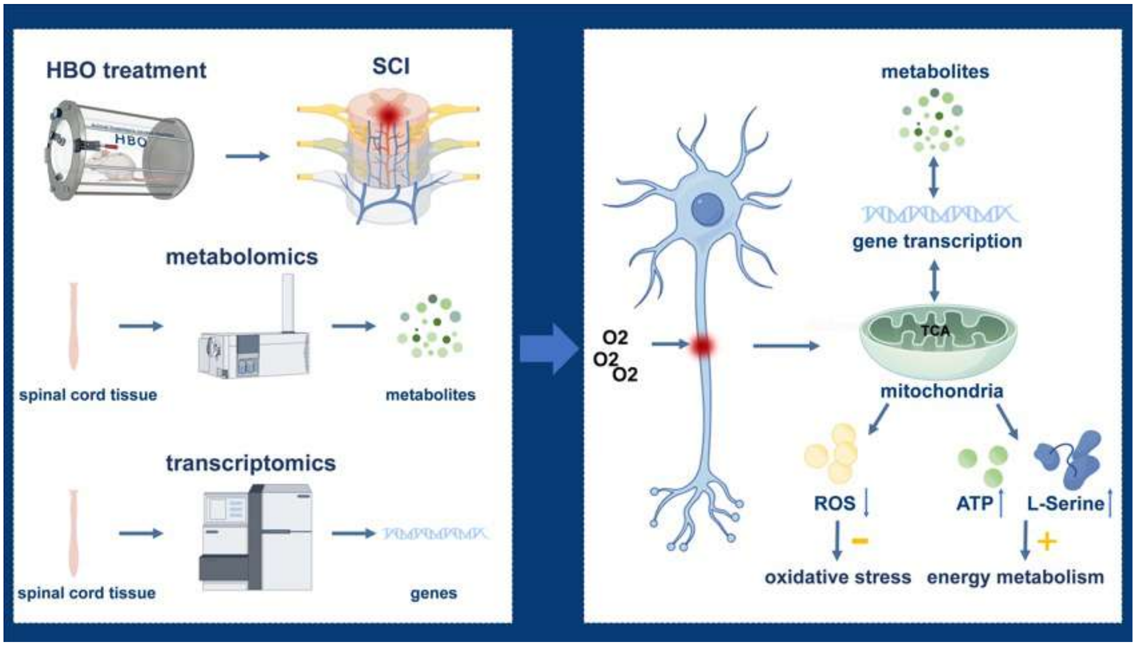
Background and Aims: Spinal cord injury (SCI) causes energy metabolism disorders and mitochondrial dysfunction. Although hyperbaric oxygen (HBO) treatment has shown therapeutic efficacy in SCI, its mechanisms related to energy metabolism and mitochondrial function remain unclear. This study aimed to investigate the mechanism of HBO-mediated neuroprotection via integrated metabolomic and transcriptomic analyses.

Methods: Mice were subjected to standardized contusive SCI and administered daily HBO treatment at 2.0 ATA for 28 consecutive days. Hindlimb locomotor function was assessed using the Basso Mouse Scale (BMS), while neuronal damage was evaluated by Nissl staining. Metabolomic and transcriptomic profiling was performed to identify differentially expressed metabolites (DEMs) and genes (DEGs), followed by integrative pathway enrichment analysis. Oxidative stress was assessed by measuring reactive oxygen species (ROS) and malondialdehyde (MDA) levels as well as superoxide dismutase (SOD) activity. Mitochondrial bioenergetic status was further characterized by ATP content, mitochondrial membrane potential, and mitochondrial respiratory chain complex protein expression.

Results: HBO treatment improved hindlimb locomotor recovery and alleviated histopathological damage in SCI mice. Metabolomic profiling revealed that HBO restored levels of energy metabolites implicated in the tricarboxylic acid (TCA) cycle and gluconeogenesis. Transcriptomic analysis showed that HBO upregulated energy and mitochondrial genes, and suppressed inflammatory and oxidative stress pathways. Multi-omics integration linked these metabolites and genes to core energy metabolic pathways. Mechanistically, HBO upregulated the expression of the mitochondrial outer membrane protein and increased ATP levels. Meanwhile, HBO alleviated oxidative stress by decreasing MDA and ROS levels and increasing SOD activity.

Conclusions: These findings indicate that HBO treatment can alleviate SCI by modulating key genes and metabolites, thereby restoring mitochondrial function and regulating pathways related to energy metabolism and oxidative stress. This study provides a theoretical basis for HBO treatment in SCI and identifies novel therapeutic targets for SCI.



EUBS2026-P.46

Two Cases of Air Embolism: One Treated Too Late and One Possibly Too Soon?

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Case description 1:
A 73 year old patient required a percutaneous CT guided lung biopsy to investigate a lung nodule potentially being cancer. He was admitted as a day case and the procedure was done under local anesthetic. The procedure itself was uncomplicated. He had a minor seizure and recovered immediately afterwards. He was admitted to an observation ward. A CT brain scan after the event was reported as fat globules in the sagittal sinus. A few hours later he had an episode of haemoptysis and a CT chest and pulmonary angiogram was arranged. He then had a seizure and short period of cardiac arrest. He was intubated and stabilised in intensive care. A diagnosis of cerebral air embolism was made. He had a USNTT6 12 hours after the biopsy. This was followed by one Table 5 and two Table 9 's. Unfortunately had a bad outcome and terminal palliative care was agreed with the family.

Case description 2:
The second case was a 26 year old patient with chronic middle ear infection and mastoiditis. She was scheduled for a mastoidectomy and tympanoplasty. The procedure was uneventful and lasted 4 hours. Her recovery after anesthesia took about 45 minutes, in contradistinction to the normal 3 to 10 minutes at most, for TIVA. It then became clear that she had an expressive aphasia. No other localising neurological signs could be found. Over the next 2 hours the surgeon, 2 consultant anesthetists, one general medical resident and the intensive care consultant on call deliberated. The patient's parents also contributed to establishing that this was completely abnormal for her. While she underwent a CT brain scan and CT venogram the on-call hyperbaric consultant was contacted and arrived with the patient in intensive care. A multidisciplinary discussion took place to discuss differential diagnoses and a management plan. The possibility of a transient ischaemic attack (TIA), hypoactive delirium, functional neurological disorder or cerebral air embolism were debated.
The consensus diagnosis was air embolism. She received one USNTT6, and made a complete recovery. We can't be sure if she would have recovered without HBO, but were satisfied with the outcome.

EUBS2026-P.47

Hyperbaric Oxygen Therapy in Autism Spectrum Disorder: Rationale and Current Clinical Evidence

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Background and Aims:
Autism Spectrum Disorder (ASD) is a heterogeneous neurodevelopmental condition associated with neuroinflammation, oxidative stress, mitochondrial dysfunction, immune dysregulation, and regional cerebral hypoperfusion. No established therapy currently targets these underlying biological mechanisms.

Hyperbaric oxygen therapy (HBOT) has been proposed as a potential adjunctive therapeutic approach because of its effects on tissue oxygenation, cerebral perfusion, neuroinflammation, mitochondrial function, angiogenesis, and neuroplasticity. However, its clinical role in ASD remains controversial.

This review evaluates the biological rationale and current clinical evidence regarding HBOT in ASD, with particular focus on underlying neurobiological mechanisms, patient selection, and methodological quality. By integrating mechanistic data, functional neuroimaging findings, and evidence-based clinical analysis, this work explores potential responder subgroups and future biomarker- and imaging-guided investigational HBOT strategies.

Methods:
A narrative evidence-based review of literature published between 2000 and 2025 was conducted using PubMed, Embase, and the Cochrane Library.

Eligible publications included randomized controlled trials, observational studies, systematic reviews, meta-analyses, translational investigations, and selected experimental studies relevant to HBOT in ASD.

Particular emphasis was placed on cerebral hypoperfusion, neuroinflammation, oxidative stress, mitochondrial dysfunction, neuroplasticity, and functional neuroimaging findings. The available evidence was methodologically appraised regarding study design, patient heterogeneity, HBOT protocols, outcome measures, follow-up duration, reproducibility, and risk of bias.

Results:
Several studies reported improvements in language, social interaction, attention, and behavioral outcomes following HBOT, particularly in patients demonstrating cerebral hypoperfusion or metabolic abnormalities. Proposed mechanisms include improved cerebral oxygenation, modulation of neuroinflammation, enhanced mitochondrial function, angiogenesis, and neuroplasticity.

However, the overall evidence remains heterogeneous and methodologically limited because of small sample sizes, inconsistent treatment protocols, variable outcome measures, and risk of bias. Systematic reviews and Cochrane analyses concluded that current evidence is insufficient to support routine clinical use of HBOT in ASD.

Conclusions:
HBOT demonstrates biological plausibility and potential therapeutic relevance in selected ASD populations, particularly in individuals with objective evidence of cerebral hypoperfusion or metabolic dysfunction. However, current clinical evidence remains insufficient for routine therapeutic recommendation.

Future research should focus on large, well-designed randomized controlled trials using standardized protocols, biomarker-driven patient selection, and functional neuroimaging in order to identify potential responder subgroups and clarify the role of investigational HBOT in ASD.

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EUBS2026-P.48

Clinical Application of a Barotrauma Early Detection and Response System During Hyperbaric Oxygen Therapy

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Background and Aims:
Barotrauma is the most common side effects of hyperbaric oxygen therapy, and no method has been developed to completely prevent it. Efforts for pressure equilibrium are difficult to apply to patients with reduced consciousness or cognitive and behavioral abnormalities. Therefore, the development and clinical application of a system that can prevent and cope with barotrauma is essential, and the researchers developed a headset-type system (Anti-Barotrauma System: ABTS) and applied it to clinical trials.

Methods: The study was conducted at three medical institutions in a prospective parallel design. Participants were randomized into two groups. Video Otoscope was applied before and after treatment, and images were saved to measure the degree of injury by otoscopic observation using Modified Edmond's Score. All participants were assessed for ear pain using pain scale. The number of treatment discontinuations due to barotrauma and participants satisfaction were measured.

Results: There was a difference in the presence of ear pain with 7 participants in the test group and 12 participants in the control group. The mean scale of ear pain was also different with 4.8 in the test group and 5.5 in the control group.($p<0.05$) Edmond's Score before and after treatment was 1.44 and 1.5, and 1,5 and 1,61 in the test group, respectively. The number of treatment stops during pressurization was higher in the test group at 5.02 and the control group at 1.83. The total time used for decompression during pressurization was also longer in the test group at 212.7 seconds and 122.5 seconds.

Conclusions: The use of ABTS may help in the early detection and prevention of barotrauma. It can reduce ear pain and the tympanic membrane injury. However, it may increase the number of pauses during pressurization and the time spent decompressing, resulting in an increase of total treatment time. The need to request a headset-like device may contribute to decreased satisfaction. This can be improved with modifications to the algorithm and headset design in the future.

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EUBS2026-P.49

Efficacy of Adjuvant Hyperbaric Oxygen Therapy in an Infant With Osteomyelitis: A Case Report

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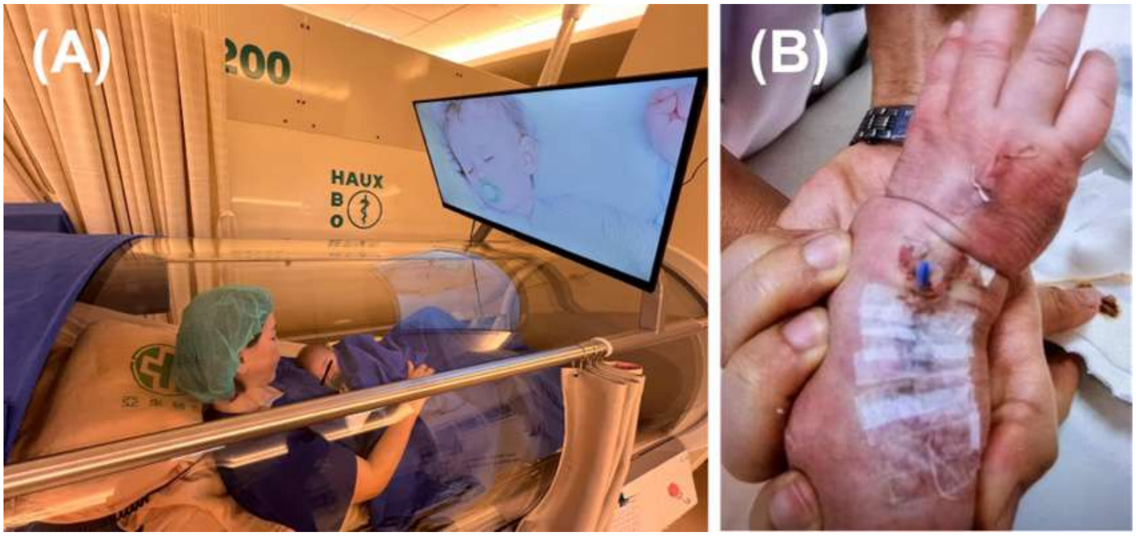
Case description: This case report describes a 4-month-old female infant presented with significant swelling and deformity of the left forearm. History included a 14-day external hospitalization (Feb 2–15, 2025) for Methicillin-resistant Staphylococcus aureus (MRSA) bacteremia and soft tissue infection. Despite management, swelling recurred on Feb 27th, prompting her mother to bring her to our emergency department for treatment. Upon admission, radiographic evaluation revealed a pathological fracture of the left radius with subsequent development of osteomyelitis. Management was clinically challenging due to compromised local blood perfusion and extensive bone destruction. The patient received systemic antibiotic therapy with Teicoplanin. Surgical interventions, including sequestrectomy and debridement, were performed on March 18th, April 15th, and April 22nd, 2025. Pathological examination confirmed the diagnosis of osteomyelitis, and cultures from the wound and bone fragments identified MRSA.

Adjuvant Hyperbaric Oxygen Therapy (HBOT) was initiated on April 8th, 2025, using a protocol of 1.5 ATA for 60 minutes per session, totaling 10 sessions. To ensure safety and treatment tolerance of the infant, a respiratory therapist accompanied the patient inside the monoplace chamber during each session. Following HBOT, inflammatory markers showed significant improvement: the white blood cell (WBC) count decreased from 24.56 to 10.17 (10^3/μL), and C-reactive protein (CRP) levels dropped from 0.75 to 0.037 (mg/dL). Notably, serial cultures confirmed successful MRSA eradication from both soft tissue and bone by April 26th, 2025. Ophthalmological follow-up confirmed no evidence of retinopathy or cataracts associated with HBOT. Literature suggests that HBOT enhances the oxygen-dependent killing mechanism of neutrophils, providing a synergistic effect with antibiotics against MRSA. Furthermore, a hyperbaric environment stimulates osteoblast activity and collagen synthesis, facilitating bone remodeling and neovascularization. Recent research has observed a 7.76-fold increase in recovery likelihood with full-course completion (OR 7.76, $p = 0.012$). This highlights the dose-dependent efficacy of HBOT in promoting bone healing and eradicating persistent infection.

Conclusions:
Early adjuvant HBOT synergizes with antibiotics to control MRSA and optimize bone healing. This 4-month-old infant's success underscores HBOT's safety and clinical value for refractory osteomyelitis in early infancy, providing a vital reference for such vulnerable pediatric cases.



EUBS2026-P.50

Impact of Early Hyperbaric Oxygen Therapy on 3-Month Recovery in Sudden Hearing Loss

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Background and Aims: Idiopathic sudden sensorineural hearing loss (ISSNHL) is the loss of sensorineural hearing in at least 3 consecutive frequencies, occurring within less than 72 hours, with no known cause after an etiological study. The main treatment is corticosteroid therapy (CST). Hyperbaric Oxygen Therapy (HBOT) is used in severe cases that are refractory to CST. We propose the use of HBOT as an adjunct to CST, started as early as possible (ideally within the first 15 days), to improve outcomes in cases of severe ISSNHL.

Methods: This is a retrospective observational study involving 133 patients diagnosed with ISSNHL, who were treated with the standard CST regimen prescribed by otolaryngologists (by oral, intravenous, or intratympanic routes), and received 20 sessions of HBOT at 2.2 and 2.5 ATA for 60 minutes. Audiometric evaluations were performed after the 15 - 20 sessions, with follow-ups at 1 month and 3 months after completing HBOT. Baseline prognostic factors have been evaluated: age, sex, ear affected, delay before starting treatment, associated symptoms: vertigo, tinnitus, etc; cardiovascular comorbidity, type of audiogram: flat, ascending (low frequencies), descending (high frequencies), or trough-shaped (mid frequencies), and degree of hearing loss at baseline.

Results: A significant improvement ($p<0.001$) in hearing of at least 10 dB was achieved in 76,69% of patients treated with CST and HBOT (7.52% of patients achieved complete improvement, 29.32% achieved good improvement (more than 30 dB), and 39.85% achieved partial improvement (between 10 and 30 dB)). This improvement was maintained during follow-up at both 1 month and 3 months. Initiating HBOT within 14 days of the onset of ISSNHL resulted in a significant improvement in hearing of more than 30 dB ($p < 0.008$) compared with patients who began treatment later. No statistically significant differences were observed when comparing treatment outcomes based on baseline prognostic factors.

Conclusions: HBOT is beneficial for the evolution and improvement of ISSNHL as an adjunct treatment to CST. Early initiation of HBOT, within the first 14 days, leads to sustained hearing improvement at 3 months compared to patients who started HBOT later.

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EUBS2026-P.51

Hyperbaric Oxygen Therapy in Burn Care - A Case Series From a Single Center Experience

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Background and Aims:

Burn injuries represent a significant global health burden, resulting in a statistically significant burn-related death rate. Despite the existence of standardized treatment protocols, major challenges persist regarding patients' susceptibility to burn-related complications and prolonged hospitalization. Hyperbaric Oxygen Therapy (HBOT) has recently gained attention for its role in tissue regeneration, with recent European consensus statements reinforcing its therapeutic value in several clinical conditions, especially burn management. This case series aims to provide practical insights into the therapeutic potential of Hyperbaric Oxygen Therapy (HBOT) for optimizing outcomes in burn wound care.

Methods:

A retrospective case series of seven patients treated at the Hyperbaric and Subaquatic Medicine Center (CMSH – Hospital das Forças Armadas- Polo Lisboa) was conducted. Following institutional ethical and scientific approval, digital and physical medical records indexed under “Burn Wounds” were reviewed. Exclusion criteria comprised patients with insufficient clinical data and those who failed to initiate Hyperbaric Oxygen Therapy (HBOT) following their initial eligibility consultation.

Results:

These cases provide practical insight into the integration of Hyperbaric Oxygen Therapy in acute and chronic burn wound management protocols and local infection control. The evidence points to potential improvements in wound healing and reductions in complication and hospitalization rates, though challenges remain in uniformly implementing HBOT strategies and dealing with logistical incompatibilities between institutions.

Conclusions:

This case series emphasizes the continuing challenges of burn wound management, exploring the application of Hyperbaric Oxygen and its potential benefit in enhancing clinical outcomes of the burnt patient. Further investigation is appropriate for the uniformization of treatment protocols and patient selection.

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EUBS2026-P.52

HORuS 2050: A Multicentre Prospective Cohort and Biobank Study of Hyperbaric Oxygen Therapy Outcomes

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Background and Aims: Hyperbaric oxygen therapy (HBOT) has 10–15 accepted indications but only 4–8 adopted and reimbursed in Europe owing to limited high-grade evidence. Most existing studies are small and not often adopted into routine practice [1]. Structured real-world outcome HBOT data are very limited [2]. Recent advances in immunology and cellular biology provide renewed mechanistic rationale for systematic study across medical fields [3]. HORuS 2050 was initiated to address the evidence gap on how HBOT is used, in whom, and to what effect under real-world conditions.

Methods: HORuS 2050 is a multicentre prospective longitudinal observational cohort study with an embedded purpose-bound biobank, sponsored by Nubiss GmbH (Berlin). Initial participating countries include Sweden and Poland, with additional European sites in preparation. Other than in existing registries such as Red Cap, Nubiss involves patient specialists or GPs to contribute and provide additional data. Eligible participants are all individuals accepted for HBOT at a participating centre, at any pressure, gas mix or indication, and who provide informed consent; healthy volunteers are also eligible to form a propensity-matched reference cohort. Exclusion criterion is inability to comply with study procedures or informed consent (e.g. cognitive impairment or language barriers). Patient-reported outcomes (EQ-5D-5L, FSS, EORTC QLQ-C30, EPIC-26, LENT-SOMA), wearable biometrics, treatment parameters and optional biological samples (≤250 mL blood/year) are captured longitudinally on the Nubiss digital platform. Analyses use linear mixed-effects models with multiple imputation.

Results: HORuS 2050 is currently in the pre-recruitment phase. No outcome data are available at the time of submission. Ethical submissions, study registration and site activation are in progress. First participant enrollment is anticipated in 2026.

Conclusions: HORuS 2050 will deliver the first European real-world dataset on HBOT utilization, outcomes and safety across accepted and emerging indications. Outputs are designed to generate hypotheses and biomarker signals, support future interventional trial design, and inform evidence-based guidelines and reimbursement decisions. HBOT centres across Europe are invited to join the HORuS 2050 consortium: horus-2050.org.

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Validating the Geratherm Bluestik Spirometer Under Hyperbaric Conditions

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Background and Aims: Spirometry is a fundamental tool for assessing pulmonary function, commonly used for diagnosis and management of respiratory conditions.[1] While spirometry is usually conducted at atmospheric pressure (1 ATA), hyperbaric environments, such as those encountered in diving and hyperbaric medicine, demand a precise understanding of pulmonary function under elevated pressures. This study evaluates the performance of a wireless, portable spirometer (Geratherm Bluestik, Geratherm Medical AG, 2025) under hyperbaric conditions to assess its accuracy and reliability.

Methods: A series of controlled calibration tests was conducted using a certified 3-litre calibration syringe at pressures of 1 ATA, 1.5 ATA, 2 ATA, and 3 ATA. The spirometer was placed inside a hyperbaric chamber, while the computer stayed outside connected together by Bluetooth. The measurements were recorded using Blue Cherry software (Geratherm, 2025). Each test was done twice on two separate days using different disposable flow sensors to account for potential variability. The Bluetooth connection stability between device and computer was monitored throughout the tests. Statistical analysis was performed using Mann-Whitney U tests to assess reproducibility.

Results: At 1 ATA, the spirometer operated within expected accuracy, conforming to ATS/ERS guidelines[2], requiring no pressure corrections. However, when the calibration was done at elevated pressures (1.5, 2, and 3 ATA), correcting for ambient pressure conditions ensured that the measured volumes closely aligned with the expected 3-litre calibration standard. No significant differences between measurements were obtained on two test days for both inspiration and expiration ($p=0.73$ and $p = 0.57$, respectively), demonstrating high reproducibility and consistency. Additionally, the Bluetooth connection remained robust and stable at all pressure levels, guaranteeing uninterrupted data transmission.
During both compression and decompression cycles, no differences between the outcomes were observed. The measured volumes during decompression matched those recorded during compression after correction for ambient pressure, and all were within 3%, conforming to the guidelines. This confirms the device's accuracy under hyperbaric conditions when appropriate pressure corrections are applied.

Conclusions: The Geratherm Bluestik spirometer demonstrated reliable and accurate performance across all tested pressures with a maximum of 3 ATA, with stable Bluetooth connectivity, supporting its suitability for use in hyperbaric environments.

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EUBS2026-P.54

Heart Rate Variability as a New Approach to Predict Seasickness

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Background and Aims: Motion sickness remains a common operational issue during naval deployments, impairing performance and well-being. Autonomic nervous system dysregulation, particularly altered vagal activity, is thought to contribute to symptom onset and severity. We investigated whether heart rate variability (HRV), a non-invasive marker of autonomic regulation, reflects symptom evolution and could be used to monitor or predict seasickness.

Methods: During a 4-week naval training mission in the English Channel, thirteen military students took part in repeated navigation exercises consisting of 5 consecutive days at sea (24 h/day), followed by 2 days ashore each weekend, aboard two minehunters. Six participants (4 females, 2 males ; age : 23.5 ± 3.1 years ; height : 172.8 ± 7.2 cm ; weight : 72.3 ± 8.1 kg) developed motion sickness with vomiting and received an oral scopolamine pill containing 0.2 mg of scopolamine, 100 mg of caffeine, and 20 mg of cinnarizine. HRV was continuously monitored at sea using a purpose-built sensing system based on Garmin Fenix 7 smartwatches (Decorte, 2025). HRV values were analysed with Kubios HRV software (Kubios Oy, Kuopio, Finland) on 20-minute recordings sampled before each treatment phase (n = 24): 1 h before pill ingestion when symptoms were maximal (−1 h), 1 h after treatment when symptoms had almost resolved (+1 h), and 8 h after treatment (+8 h). Medical evaluations were performed twice daily, including symptom recording.

Results: Significant parallel changes were observed in HRV indices. SDNN, RMSSD, LF and HF Power, SD1 and SD2 increased significantly at +1 h, then declined again at +8 h (all $p < 0.05$). Conversely, Stress Index decreased after treatment and rose again with symptom recurrence ($p < 0.05$). HRV dynamics closely mirrored clinical symptom changes.

Conclusions: These findings support a role of vagal/autonomic pathways in seasickness. As reduced HRV has also been associated with inflammation (Williams, 2019), HRV may reflect both neural and physiological stress responses during motion exposure. HRV may therefore represent a rapid, wearable, non-invasive biomarker for real-time monitoring and potentially prediction, of motion sickness in maritime operations.

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EUBS2026-P.55

Why Is Gastric Barotrauma Such an Infrequent Complication During Submarine Escape?

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Background and Aims: Gastric rupture caused by expanding gases during decompression is an extremely rare, but very severe, diving related complication. Recently a report was published (Risberg et al 2025) on a gastric rupture that occurred in conjunction with an international Royal Navy-led exercise in submarine escape carried out in 1987. It has previously been shown that during pressure-equalization manoeuvres of the middle ear and sinuses during diving air is often ingested and the volume of swallowed gas can amount to several decilitres (Brattström et al 1975). During the rapid compression phase of submarine escape the submariner must perform frequent pressure equalizations. At the same time, the ascent rate during submarine escape is very fast, which should result in a rapid increase in the volume of any swallowed gas. In comparison to other dives the ascent speed during submarine escape is more than a magnitude faster (e.g. 2.7 m/s vs 9 m/min). However, the authors noted that this was the only case in connection with submarine escape or escape training that has been reported, even though the rapid ascent rate would be expected to increase the risk not only for pulmonary but also for gastric barotrauma.

Methods: In this presentation, the time and pressure profiles of deep submarine escapes as well as the method for pressure equalizing during the rapid compression are analysed.

Results: This analysis shows that the risk of gastric barotrauma only arises if gas is swallowed during a very short phase of the ascent, namely during the short period when the submariner exits the escape tower. Reading the original accident report (Haydon & Fox 1987) indicates that it was likely during this phase that the submariner swallowed air.

Conclusions: In conclusion gastric barotrauma is only likely to occur during submarine escape if air is swallowed during the few seconds when the submariner is exiting the escape hatch, which explains why this event is so rare despite the large ascent speed.

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EUBS2026-P.56

Cost of a Hyperbaric Medicine Unit in a Regional Hospital: The Case of Palamós

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Background and Aims:

The Hyperbaric Medicine Unit (UMH) at Palamós Hospital was established in 1994. In 2010, a new multiplace hyperbaric chamber with a capacity to treat up to 8 people was installed.

To analyze the activity of a hyperbaric medicine unit and the operating costs incurred during its first 14 years of operation

Methods:

Data on composition, staffing structure, operations, activities performed, and associated costs were collected from the UMH's activity and financial reports.

All costs are included: installation costs, personnel costs, on-call costs, maintenance, consumables, indirect costs, and depreciation of the facility. Costs are presented adjusted for inflation in 2023 euros. Individualized data are presented for the years 2010–2023.

Results:

The number of annual treatment sessions has increased from 1,373 (in 2010) to 2,717 (in 2023), with an average occupancy rate on weekdays of 78.6%. In 2023, 21 diving accidents and 27 cases of carbon monoxide poisoning were treated, representing 33% of the people treated, but only 4% of the treatment sessions.

The average annual cost, adjusted for inflation, was €704,671.51. Of this, personnel costs accounted for 69.1% (28.4% permanent staff and 40.7% on-call staff). Indirect costs accounted for a further 20.6%.

The cost of a treatment session ranged from €554.08 (2010) to €229.04 (2023).

Conclusions:

The main cost factor for the UMH was personnel costs associated with maintaining an immediate response service (24 hours a day, 7 days a week).

Even in a hospital with prior experience with OHB, it took 14 years to reach an occupancy rate of nearly 80%.. The cost per session was influenced by the level of activity performed.

Knowing the actual cost data for this practice is necessary to conduct any cost-effectiveness study of TOHB.

EUBS2026-P.57

Hyperbaric Oxygen Therapy (HBOT) in Catalonia: A New Organisational Model

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Background and Aims: Hyperbaric oxygen therapy (HBOT) is an established treatment for accepted urgent and scheduled indications. However, in many European regions, access remains heterogeneous, referral pathways are unclear, and integration within public healthcare systems is limited. Despite more than 30 years of HBOT activity in Catalonia (Spain), no unified framework previously existed to define indications, territorial coverage, emergency coordination, quality standards, or operational governance.

To design and implement a region-wide organizational model integrating HBOT into the Catalan Integrated Public Health System (SISCAT), providing equitable, safe, efficient, and standardized access for the entire population.

Methods: During 2025, the Catalan Health Service (CatSalut) coordinated a multidisciplinary consensus process involving healthcare administrators, hyperbaric physicians, nurses, chamber operators, public integrated Emergency Medical System (SEM), and representatives of the two active SISCAT hyperbaric units: Hospital Moisès Broggi and Hospital de Palamós. Development methodology included structured working meetings, review of international recommendations, analysis of local activity, regulatory requirements, logistics, and clinical pathways.

Results: The final model established a coordinated regional HBOT network based on two reference centers covering a population of approximately 8 million inhabitants. Three standardized access pathways were implemented: emergency, inpatient, and outpatient care. The framework defines referral criteria, prioritization algorithms, chamber technical standards, staffing competencies and safety procedures, contingency plans for chamber downtime, activity clinical coding rules, and quality indicators for continuous evaluation. Combined annual activity from both centers exceeded 9,800 HBOT sessions, including treatment of carbon monoxide poisoning, diving accidents, radiation injury, chronic wounds, osteonecrosis, and other evidence-based indications. Critical care capability for ventilated patients was centralized in the multiplace unit at Hospital Moisès Broggi, while territorial scheduled and other urgent activity was shared across both centers.

Conclusions: This represents one of the first fully integrated regional public healthcare HBOT networks described in Europe. The Catalonia model demonstrates that hyperbaric medicine can be successfully embedded within a modern public system through structured governance, coordinated referral circuits, quality metrics, and equity-based planning. This scalable framework may serve as a reference for other European regions seeking sustainable integration of HBOT services.

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