



Oxygenate yourselves! - The Hyperbaric Centre magazine

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In 2010, the Hyperbaric Centre of Ravenna opened the blog www.iperbaricoravennablog.it to share the stories of patients because we believe that the solution to a problem for one patient may be the solution for many others. This experience led to "*Oxygenate yourselves!*", the blog magazine of the Hyperbaric Centre, a new tool to read and save the most-read stories of the blog. This number contains the articles that were read the most in March and April 2015! Enjoy the reading!

Sara, from the collaboration with the Hyperbaric Centre to the book with Timothy da Costa



Sara Vignoli is physiotherapist and expert in postural re-education, at the Hyperbaric Centre follows patients who need rehabilitation for neurological problems.

Sara is a passionate young volleyball player from Ravenna. After a small injury during a match when

she was 15, she has been followed by a physiotherapist and remained so fascinated by that discipline that she decided to make it her job. After highschool she joined the faculty of Medicine of Bologna, where she graduated in physiotherapy in 2010.

In 2011, in Milan, she got the qualification of "Technician of postural balance to comprehensive approach, Raggi Method® with Pancafit®" and in 2012 she got a certificate in "Posturology applied: muscle tests and applied kinesiology, dental occlusion and relationship with the spine, the visual system and spine biomechanics, neurology foot and postural changes", with the Dutch teacher and osteopath Timothy Da Costa.

Her professional relationship with the respected Dutch doctor continues actively, so that Sara in 2014 contributed to his latest book "Postural massage. From anatomy to physiology and postural assessment to an innovative concept of massage."

The very idea of the manual, as well as the decision to develop it in a way that made the subject available to everyone belong to the two of them; Sara in particular was responsible for writing the chapter on postural massage.

Sara loves her work and with each patient she chooses the best technique to apply according to the time, the objective and the phase of the patient. As she puts it: "the physical therapist who deals with postures must, first of all, have a global approach to the patient. Once the true cause is found, we must act on that and at the same time on rebalancing muscle. The objective is to delete the old body scheme and create a new and right one: the same patient at one point of the path will agree that before he was "wrong" and will feel better in the new postural condition."

The collaboration with the Hyperbaric Center of Ravenna began in late 2011. With us, Sara takes care of people with neurological disorders: children with cerebral palsy, people with multiple sclerosis, head trauma, stroke, neurological accidents for diving decompression.

At the Hyperbaric Centre of Ravenna these diseases are treated in combination with cycles of hyperbaric oxygen therapy (HBO), which improves the defense of the human body to oxidative stress,

improves energy receptors, and triggers stem cells facilitating neuroplasticity. The idea of using hyperbaric oxygen therapy to boost the effects of physical therapy came to the medical director of the Hyperbaric Centre, Dr. Pasquale Longobardi: physiotherapy treatment is done directly inside the hyperbaric chamber or within 90 minutes after oxygen therapy. This way, patients can take advantage of the beneficial effect of oxygen resulting in greater efficiency and many benefits for the patient.

The collaboration with the Hyperbaric Centre is strong and solid, based primarily on a great enthusiasm, with the aim to give these people hope and the best quality of life possible.

Raynaud's syndrome: I am worried for my sister



Hello,
I am writing because I am concerned about the situation of my sister.

Three years ago she was diagnosed with a rheumatologist Raynaud's syndrome. At that time she had the symptoms of the disease in winter and some small ulcers in the toes. Since then she never went to a medical visit because she was convinced of having to live with this disease. With time, however, each winter the situation was worse and now she has ulcers in each finger of the foot, and it seems she is developing ulcers also under the plant. They are red, inflamed and painful, they look like open fingers. While showering she says sometimes the tips of the toes turn black.

She underestimates the problem, convinced that there is nothing to do, and due to daily commitments she puts off constantly. But now I've seen the situation and I convinced her to take an appointment with a dermatologist, even if I don't know whether it is the right specialist. Please give me information and guidance. Thanks.

Klarida Hoxha responds



Dear Silvia, I'm sorry for your sister and that you are worried about her situation. Raynaud's phenomenon is one of the manifestations of an autoimmune disease called scleroderma. It is an inflammatory process that affects the lining of the small blood vessels resulting in impaired function and microcirculation: spasms of capillaries bring momentary interruption of blood supply that creates the appearance of pale skin in fingers after exposure to cold (that's why it worsens during winter) and / or as a result of emotional stress, until the appearance of small ulcers.

Scleroderma is a chronic inflammatory disease of the autoimmune basis of connective tissue that is the tissue that connects the parts of our body; like a spider's web, the fibers of this fabric connect cells and form tissues and organs. The connective tissue is found throughout the body and collagen is a protein that constitutes it. The increased production of collagen induced by this disease primarily causes thickening of the skin. The specialist of reference is the rheumatologist, who deals with diseases of connective tissues in correlation with changes in the immune system.

At the Hyperbaric Centre we often see similar cases to your sister's. The therapy adopted includes a first visit in which we collect different parameters to frame the situation.

There is not yet a radical cure of the disease and the treatment that tries to normalize the immune phenomena is anti-inflammatory and immunosuppressive. However, hyperbaric therapy could improve Raynaud's phenomenon by increasing blood flow capillary skin in order to decrease the persistent vasospasm, the number and intensity of incidents and prevent progression to ulceration of knuckles and fingers tips.

Hyperbaric therapy has to be done associated with drug therapy that dilates the vessels called vasodilators. The therapy can be taken orally or by infusion, particularly infusions of prostanoids cyclically.

Furthermore, it must be accompanied by antiplatelet therapy with aspirin in small doses to prevent micro-thrombosis.

To this type of therapy and to the sessions in hyperbaric chamber we associate a cycle of FREMS therapy, a type of electrostimulation able to increase the release of nitric oxide by the endothelium of blood vessels. The nitric oxide is an

important vasodilator and therefore it can help relieve symptoms, especially during the period in which patients have more episodes and exacerbations with the aim of activating intensively micro-circulation.

Correct life habits should not be underestimated either: preventing exposure to temperature changes, quitting smoking and avoiding emotional stress. During an episode of Raynaud's, my advice is to stay calm and go in a warm place, rub your fingers, twirling arms to increase circulation and slide warm water on affected parts.

If appropriate, you can contact us directly at 0544/500152 and take an appointment for a first visit in order to better understand the situation.

I remain available, greetings, Klarida Hoxha

Leukocytoclastic vasculitis and tibial ulcer since more than three months



Hello,
I happened on your blog after a search on the internet to see how we can speed up the healing of a tibial ulcer that is plaguing my husband.

The ulcer formed in late November, after several investigations and a biopsy of the tissue the response was leukocytoclastic vasculitis (LCV).

Currently my husband is followed by the plastic surgery of the closest hospital to our city. We go here regularly for dressings that then I do from home with collagenase ointment (noruxol), iodoform gauze and then paraffin gauze (phytostimulines).

I don't see great improvements and while looking forward to have more results from blood tests to check the nature of vasculitis, I wanted to have other tips.

For now the wound is cleansed with saline solution, I read of hydrogel dressings and wondered if the Noruxol belongs to this category. Next time we go to the hospital I want to ask for Holoil and Azexin if you recommend them in this case.

Thank you in advance

Serena Giannini responds



Dear Madam, I am very sorry for the situation you and your husband are living right now.

As confirmed by the biopsy you have performed, vasculitis is an inflammation of the blood vessels that involves the whole body. The ulcer is but a symptom of the malaise that occurs in the skin.

To find the cause of an vasculitic ulcer is often complicated but at the same time you need to be able to carry the wound on the road to recovery, so it is essential to involve several specialists. Once the cause that led to the injury is identified, the choice of the most appropriate medication is after all the simplest because it is established on the basis of appropriate evaluation schemes.

Collagenase and Hydrogels are two types of dressings that have the same purpose but act in a different ways, for this reason the choice of either one depends on the specific case. Both, however, can be used in presence of fibrin or necrotic tissue for cleaning the wound.

Once the wound bed is clean, it is necessary to change the type of medication and at this stage the two oils you indicated in your request (Holoil and Azexin) are good products, because in addition to nourishing and disinfecting the wound, they maintain the cute protected and moisturized.

At the Difficult Wounds Care Centre and at the Hyperbaric Centre of Ravenna the approach we take with patients with vasculitic ulcers is holistic, meaning that we take into account the entire body and all aspects of a person's life as these diseases may have several different origins.

During the first visit, we perform a series of tests useful to frame the state of health of the patient and understand what may be the most suitable course to the person. This therapeutic pathway usually includes: wound biopsy, blood tests to assess organ function and levels of inflammation, instrumental investigations by the angiologist as the Doppler ultrasound of the lower limbs to evaluate the circulatory, rheumatology consultation

to evaluate whether steroid therapy and understand the cause of the ulcer, analgesics for pain relief and proper dressing, bandage the limb and FREMS (electrical stimulation device for the treatment of pain and stimulation of microcirculation, which is the most suffering in this case). If the wound does not decrease by at least 40% in four weeks, you can opt for additional therapies such as: Negative Pressure Therapy (NPT), platelet rich plasma (PRP), skin grafting, Hyperbaric Oxygen Therapy (HBO) and any advice from a plastic surgeon.

Keep in mind that treatment options always vary depending on the specific case and the characteristics of the person, then the only way to really succeed in finding the way that's right for your husband is to perform a visit. If you want to start a treatment at the Hyperbaric Centre we would be happy to evaluate together the best course of treatment for her husband, to have an appointment please contact our secretary at the number 0544 500152 or email to segreteria@iperbaricoravenna.it

I hope I have been helpful.

A hug, Serena Giannini

Leg injury with redness and itching: what do you advise me to do?



Four weeks ago the response to my examination was: right leg skin lesion with necrosis from extravasation of drug. Absence of superficial and/or deep venous inflammation. We recommend dressing with Betadine and cover with sterile gauze. Today the wound is surrounded by redness and bubbles with severe itching. What do you advise me to do? Thanks for all!

Marianna Monducci responds



Dear Mr Olindo, I'm sorry for your ulcer and I hope to give you an answer that will be helpful.

The framework you describe seems to refer to a traumatic ulcer, that is caused by an external agent. Given the fact that after four weeks of medication, as you described, the problem continues, I can say that more data are necessary to be able to heal the wound in a holistic manner as we proceed normally at the Hyperbaric Centre of Ravenna.

The holistic approach is the care of the patient from all points of view, that is, considering not only the problem that manifests on the physical level (in this case the ulcer), but also other aspects such as his lifestyle and his emotions. Often the injury is only the visible manifestation of the problems of this type that are the real cause of the disease and should be investigated and resolved in order to enable the person to regain serenity and heal completely.

Once we have identified the cause we can treat the physical ailment suffered by the person, but starting from its origin and not from its manifestation.

The first visit at the Hyperbaric Centre therefore consists in a collection of information about the person and data on its general conditions: blood sugar control (hemoglucotest-HGT), hemoglobin monitoring, oximetry detection in the vicinity of the wound and blood pressure both for arm and leg making the difference between them. The last two allow us to make a first assessment on oxygenation and blood flow in the affected area.

From what you wrote I assume you have already performed a medical examination, in order to be able to better help you, it would be helpful to know what kind of drug caused the wound. From what you say we could be dealing with an allergic reaction, and in that case it would be useful to discontinue the drug, of course after consulting the doctor who prescribed it.

Following the disclosure of this information we can then proceed to the choice of most suitable protocol for your situation. The CCFD (Difficult Wounds Care Center) located at the Hyperbaric Center of Ravenna, we use advanced dressings and bandages to speed up the healing process.

If you don't obtain short-term improvements I suggest you call the CCFD for an appointment.

Contact the secretariat of the Hyperbaric Centre at 0544 500152. We will set the course of treatment that is best for you.

Best wishes, Marianna Monducci

Ankle prosthesis infection: is it better hyperbaric therapy or surgical debridement?



Good morning, I stumbled upon your blog and thought I'd write to you to have a consultation.

My mother had a ankle arthroplasty done four years ago. In mid-November 2014 she began to experience symptoms such as fever, swelling, pain and general discomfort with clinical evolution to a fistula with leaking pus and she was diagnosed with abscess.

For this reason, she underwent surgery to remove the implants and insert an antibiotic-loaded cement spacer. She also started an antibiotic therapy (the detected bacterium was the *Staphylococcus aureus*). She continued antibiotic therapy for 6 weeks until the PCR was negative.

After 20 days of therapy suspension she had a labeled autologous leukocyte scintigraphy, which had a positive response with the infection process yet in place, although the clinical picture was greatly improved.

Now the infectious disease specialist told us that we must make a new surgical cleaning with change of the spacer, while the orthopedic proposed another antibiotic therapy and sessions in a hyperbaric chamber.

Coming down to it, I wanted to ask if the hyperbaric therapy may be more effective than surgical cleaning to facilitate healing. We can choose freely among these options, but before deciding I would like to be better informed because

I do not know much of the topic and I would like to make the best decision for my mom.

Thank you in advance, Fabiana

Dr Nedjoua Belkacem responds



Dear Fabiana, first of all thank you for the interest you show for our center. I carefully read your request and I will respond with more clarity as possible.

You tell us that the problem your mom is experiencing is due to an infected prosthetic ankle positioned four years ago and replaced in November 2014 with a spacer in antibiotic-loaded cement. You also described the infection was treated with antibiotics that improved the symptoms but that did not eliminate the infection, as shown by labeled leukocytes scintigraphy.

Now you do not know whether to make a new surgical debridement with removal of the spacer as recommended the infectious diseases specialist or to choose hyperbaric therapy associated with antibiotics.

When there is a infection of a prosthetic joint, in this case of the ankle, in order to resolve the infection it is common to remove the prosthesis and, if possible, to replace it with a new prosthesis. To increase the chances of success of the intervention, usually the replacement of the prosthesis is not done immediately after removing the infected, but first doctors prefer to implant a temporary restoration of bone cement with added antibiotics, the so-called antibiotic-loaded cement spacer that was implanted to your mother. This temporary prosthesis enables to sterilize the joint as much as possible, and afterwards (usually after 2-4 months), to proceed with the replanting of new prosthetic joint.

Unfortunately in the case of your mother this objective has not been achieved and she finds herself with an infected temporary spacer. In the future she will certainly have to undergo a second surgery for implanting the final prosthesis, but now, in my opinion, it is not recommended because of the presence of the infection that threatens to contaminate it.

On the other hand, the exclusive use of local (infiltration) and general (oral) antibiotics at high doses and for long periods does not help. In fact the bacteria that colonize the surface of the prosthesis with the passage of time develop a

protective barrier against antibiotics, called biofilm, which then become less and less effective.

Considering that there are not other therapies that replace surgery to remove radically the source of infection, but that is now impossible for your mother given her conditions, I would suggest the hyperbaric oxygen therapy which, thanks to its ability to reduce bacterial load, allows to remarkably reduce the infection. This will prepare the ankle for the surgery for replacing the spacer, which presumably will be executed at a later time, making it more effective, less bloody and less demolitive.

It has also to be considered the ability of hyperbaric oxygen to reduce inflammation and consequently pain. Keep in mind that it is a non-invasive therapy: it comes to inhale pure oxygen in an environment (the hyperbaric chamber) compressed with air and brought to a pressure greater than atmospheric.

If you are interested in the hyperbaric therapy we can evaluate together what to do and the feasibility of this therapy considering the clinical condition of your mother, particularly cardiology and pulmonary speaking.

In this case, I suggest you contacting our office at 0544 500152 and request an appointment for a medical examination.

I remain at your disposal for further clarification and I wish you a happy outcome.

Dr Nadjoua Belkacem

Osteomyelitis after an accident with fracture



Good morning, four years ago I had an accident with fracture of the tibia. Since that time I had several surgeries done, including flaps. Now I find myself with an

osteomyelitis infection. I would like some advice from you, thank you!

Dr Andrea Galvani responds



Good morning Mr Roberto, I'm sorry for your clinical situation.

Chronic osteomyelitis is an infection of the bone and its medulla. Unfortunately, as in your case, sometimes it can occur due to a fracture of a bone such as the tibia.

It is a problem with a clinical picture sometimes very complex, so in order to express an opinion correctly and see if we can really help you, it is absolutely necessary you come for visit and a careful analysis of all medical examinations and medical history.

The therapy of the Hyperbaric Centre of Ravenna for patients suffering from chronic osteomyelitis involves a series of expert advice:

- Infectious diseases specialist: to identify most suitable antibiotics

- Orthopedic: to assess the possibility of a surgical drainage (surgery). If surgery is necessary it is expected another advice of Physiatic specialist to establish the physical therapy and rehabilitation to be taken following the operation

- Hyperbaric: to exclude risk factors to the cycle-hyperbaric oxygen therapy (HBO). If the risk factors are absent, the hyperbaric physician will prescribe the most appropriate protocol HBO establishing the number of sessions in a hyperbaric chamber required, duration of each session and pressure in a hyperbaric chamber

- Wound Care Specialist: to evaluate the best cycle of advanced medications to prepare the bottom of wounds

If necessary in your case, through our center you can also undergo a cycle of "non-specific immunotherapy," a series of injections designed to stimulate the immune system.

After that you will be subjected to different expert advice and we have verified the course of treatment most suitable for you, the Hyperbaric Centre will treat your problem with a multidisciplinary approach, as much as possible to increase the chances of recovery.

For any further information or for logistical information on how to reach the Hyperbaric Centre you can contact our office at 0544 500152. If you want you can also send your health records to the email segreteria@iperbaricoravenna.it: a doctor of the center will analyze the reports and will give you some more precise information on your case.

I hope I was clear enough and to have answered to your doubts. I send a big good luck for a fast recovery from your problem.

Sincerely, Dr Andrea Galvani

Cellulite: how to reduce it before the summer?



Hello everyone,

I'm 28 years old, I always played sports, but last year I started taking the pill and I noticed the appearance of cellulite. I feel very uncomfortable with the approaching summer and I am ashamed to wear a swimsuit. I would like to know if there is a solution, and if I might be able to find a remedy for this thing before the summer. Thanks, Francesca

Dr Claudia Rastelli responds:



Dear Francesca, thanks for writing to us.

As summer and sun approach many of you to ask me to help them removing unwanted skin imperfections such as "orange peel skin" or skin laxity.

The P.E.F.S. (Panniculopatia edematous fibrosclerotic), commonly called "cellulite", is nothing but an alteration of the subcutaneous adipose tissue. A hypertrophy of the fat cells occurs (the cells become larger) along with an alteration of the venous and lymphatic system with

slowing of blood flow that causes water retention, that is the stagnation of fluid in the intercellular spaces of the hypodermis.

By the time the tissue changes its conformation in organizing fibrous nodules, they give the famous irregular appearance in "orange peel". Depending on the stage of development we divide cellulite in 4 stages.

The alteration of the microcirculation and the formation of PEFS can result from various causes, including genetic, hormonal and environmental factors such as sedentary lifestyle, overweight, smoking, tight clothing, postural problems and others.

Associated with these problems it may often form a localized accumulation of fat that worsens the aesthetic framework.

At the Hyperbaric Centre of Ravenna, after a medical interview, we can define together the causes of the formation of skin imperfections and correct them as possible. It is also possible to undertake a cycle of Mesotherapy Aesthetics to improve skin appearance.

Mesotherapy involves the inoculation in the dermis of substances (drugs or homeopathy) that promote the drainage of fluids, improve microcirculation and have a lipolytic action. Through a tiny needle, these substances are injected in the area to be treated and at points along the lower limb that reactivate the excretory organs to promote the expulsion of toxins. The cycle includes at least 10 sessions once a week. In association with Mesotherapy the personalized assessment provides a home therapy with natural supplements, creams and cycles of lymphatic drainage massage.

For any curiosity and for a personalized assessment, you can contact the Hyperbaric Centre of Ravenna to the number 0544.500152.

Sincerely, Dr. Claudia Rastelli.

Andrea, Italian champion of underwater photography, solves the PFO and returns to dive!



Andrea loves sports, especially when it comes to particular and compelling experiences. He defines himself as a "collector of experiences": skydiving, caving and mountaineering; to get in the game it is on his agenda.

Among the many sports he practices, in 1980 Andrea decided to try diving and enrolled in a course in Faenza, his hometown. Until then he used to go to the sea only seasonally and without enthusiasm. Yet through this experience he begins to love the sea more and more, and discovers a passion that led him to attend all the courses organized by the Centro Sub Faenza achieving several patents of specialization, up to that of Federal Instructor of Diving FIAS.

During one of these courses, Andrea meets Enzo and Sergio, two experts in underwater photography. Thanks to their encouragement he decides to embark in a new adventure combining two great passions of his: the sea and photography.

Diving is an important part of his life and his wife, in order to share with him this passion decides to surprise him by attending a Diving course. When Andrea finds out, returning from a trek in Nepal, he can not be more excited.

The support of his wife makes him feel more and more involved in this experience and Andrea quickly reaches important goals. He gets many awards at national and international levels as an underwater photographer, he takes part in as many as 16 Italian Championships Fotosub between individual and for society, enters the Italian National Team Fotosub and wins three titles of World Champion Fotosub Team.

In 2001, Andrea decides to leave the competition but not his passion. From that moment on, he dedicates to follow underwater photography athletes of the "Centro Sub Faenza" participating to competitions Italian Fotosub Championship, he organizes courses and workshops for underwater photography athletes and join the Diving Society - Italy.

Andrea's diving path has always been very intense and fascinating, but for 15 years he is disturbed by a slight discomfort, which has never stopped him to dive but that with time becomes more and more limiting.

After each dive Andrea feels an itchy skin that could be due to dehydration problems. During the qualifying fitness visit at the Hyperbaric Centre he talks about this to Dr. Della Torre who links the problem immediately MMD skin, a decompression sickness that manifests with itchy and swellings spots similar to hives and redness.

This type of decompression sickness can be related to the presence of PFO (Patent Foramen Ovale), a cardiac anomaly that connects the right atrium to the left atrium of the heart. In fact, the communication between the two atria of the heart is normal in the fetal stage, when we are still in the womb, but usually at birth the canal is covered by a membrane that in early childhood is strengthened and does not allow the passage of blood (or bubbles). In 30-40% of individuals at birth or later in life, it happens that the membrane rises and lets blood (and clots or bubbles) pass from the right side to the left side of the heart (left-right shunt).

Many people live with this little problem without ever accuse any symptom in their lifetime, but in the case of divers it can be expressed with MDD skin. That is why Dr. Della Torre recommends Andrea to identify any right-left shunt with the assessment developed by the Hyperbaric Center for who suffer this type of problem.

The analysis at the Hyperbaric Centre implies:

- Bilateral transcranial Doppler ecography with sonographic contrast and measurement of the bubbles that pass into the vessels of the neck from both sides (the ultrasound is performed in basal condition and after the Valsalva maneuver). With up to twenty bubbles the problem is small, but the ultrasound performed by Andrea with Dr. Limoni showed a change of about one hundred bubbles between left and right.

- Arterial blood gas analysis during breathing in pure oxygen mask with a high flow. A partial

pressure of oxygen in arterial blood is greater than 400 millimeters of mercury is okay, but Andrea had a much lower pressure that confirmed the presence of a medium-large "hole".

- Transcutaneous oximetry to validate the data of the arterial blood gas analysis.

After these investigations, Andrea is visited by Dr. Longobardi, Medical director of the Hyperbaric Center, who confirms the medium-large PFO diagnosis.

Given Andrea's intense underwater activity, also at professional level, the suggestion of the doctors of the Hyperbaric Centre is to close the PFO with a surgical operation to avoid any complication while diving, Andrea follows the directions in February 2014. 4 months after surgery, last July, Andrea checks back for regular monitoring, it performs a transcranial ecodoppler and a new visit with Dr. Pasquale Longobardi: the Patent Foramen Ovale is totally closed.

Andrea can return to his passion in total safety, given the beauty of its marine reportage we are glad he can continue to dive: we look forward to his next photo shoot in the blue ocean!

Foramen ovale with many bubbles: do I have to give up diving?



Good evening, following a diving accident with undeserved Mdd I was prescribed a transcranial ultrasound Doppler whose report is as follows:

the exam was performed with two consecutive injections of sanitizing saline solution which gave positive result for broad right-left shunt with passage of numerous Hits per cardiac cycle. It was especially evident during Valsalva with curtain effect.

Conclusions: positive test for right-left shunt of severe entity evident during Valsalva and compatible with PFO.

According to a first quick consultation with the hyperbaric physician I must give up diving or have surgery. I would like to have your opinion, also in case I decide for surgery, is it certain that I can dive again or is there a risk the problem is not solved?

I have been diving since 1999 with a dive master patent and I dived several hundred times before the accident. Also I have a Normoxic Trimix Diver patent and I also do technical diving since 2007 approximately.

I look forward to your opinion. Regards, Francesca

Dr Luigi Santarella responds:



Dear Francesca, the data show that about 30% of the entire population, including divers, has a Patent Foramen Ovale (PFO). Therefore given the high incidence of PFO, it remains to be seen whether or not the PFO increases the risk of decompression sickness.

DAN (Divers Alert Network) indications concerning the presence of a Patent Foramen Ovale (PFO) in the diver does not exclude suitability for diving.

DAN believes that divers with PFO should limit to dives indicated for low degrees of doppler bubbles (30 meters of maximum depth, safety stop for two minutes at 15 meters and three minutes stop at five meters; one dive per day; no effort during the ascent). In the presence of a large PFO, DAN's data indicate a 6 times greater risk.

According to DAN, slowing the ascent, respecting safety stops, helping to minimize the presence of bubbles, contribute to reduce the specific risk of PFO, until it is not particularly significant.

The indications for fitness qualification by Sports Medicine (Cocis 2009) are more limiting: the presence of patent foramen ovale is a contraindication to diving.

The Hyperbaric Centre of Ravenna has developed a process of customized diagnosis, which allows the diver to clarify the importance of the problem and how to dive safely.

Taking into account the different scientific evidences and the opinions of leading experts in

the industry, we have developed a diagnostic path that provides:

- transcranial Doppler ecography with sonographic contrast (the presence of up to twenty bubbles shows a slight problem).
- Arterial blood gas analysis during breathing in pure oxygen mask with a high flow. A partial pressure of oxygen in arterial blood greater than 400 millimeters of mercury is in the norm, a lower pressure confirms the presence of a shunt in the circulatory system and enables to define its dimensions
- Transcutaneous oximetry to validate the data of the arterial blood gas analysis

The final decision is mathematically certain:

- Less than twenty bubbles and blood oxygen pressure greater than 400 mmHg: the patient can continue diving
- Over twenty bubbles and pressure of oxygen in the blood below 400 mmHg: depending on the severity of the problem you decide whether to allow diving with prudential rules or whether to proceed with the closure of the shunt.

In case of closure of PFO, we suggest a program of controlled diving for rehabilitation after the first check with transthoracic doppler, performed a month after surgery. After six months we program the visit for the final go-ahead to dive without restrictions (within the limits set by the patent).

Regarding your case it seems that the incident from decompression sickness is related to the presence of the PFO and then it would be appropriate an surgical approach to close the shunt.

On the other hand, it is important to take into account you experienced a single episode of decompression sickness in countless dives.

If you want, the Hyperbaric Centre of Ravenna (0544-500152, segreteria@iperbaricoravenna.it) is available for a second opinion by a visit of the neurologist (dr. Paolo Limoni) for doppler and a visit of the diving specialist for the final evaluations. It runs every Tuesday and the commitment is of half a day.

Best regards, Dr. Luigi Santarella.



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