SUHMS

SWISS UNDERWATER
AND HYPERBARIC
MEDICAL SOCIETY

PFO

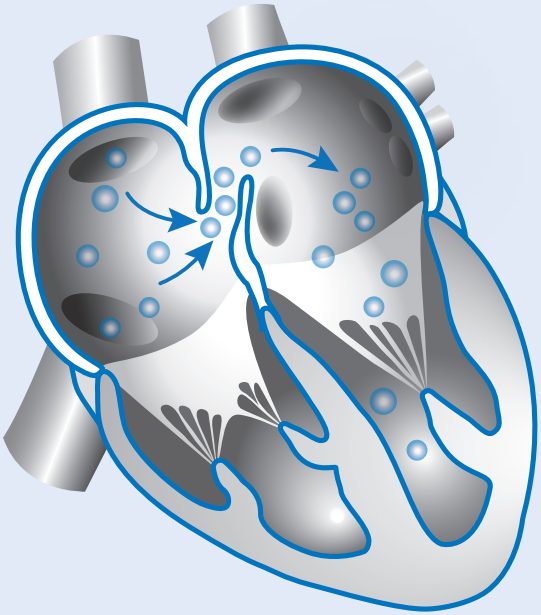
PATENT FORAMEN OVALE

RECOMMENDATIONS
OF THE SWISS UNDERWATER AND
HYPERBARIC MEDICAL SOCIETY
«SUHMS»

Schweizerische Gesellschaft
für Unterwasser- und Hyperbarmedizin
Société suisse de médecine subaquatique
et hyperbare
Società svizzera di medicina subacquea
e iperbarica

PFO – PATENT FORAMEN OVALE

The foramen ovale is a valve-like opening between the right and left atrium of the heart. This communication is essential during the intrauterine phase until birth, allowing the circulation to bypass the lung.
After the first breath of the newborn, the foramen ovale becomes superfluous.
In about 75% of people this opening closes or seals within the first few years of life. In the remainder of the population, this "door" never closes, but is left ajar.



PREVALENCE

The PFO is therefore not a disease, but a variant within the norm that can be found in roughly one quarter of the population. Therefore, one out of four recreational divers may dive with a PFO.

RISK

Due to the local flow characteristics the risk of material transfer through a PFO is low. However, if a rise in intrathoracic pressure lasts over several seconds, the increase of the pressure in the right atrium might be sufficient to "pop the door" open, thus permitting small amounts of blood to cross to the left side of the heart and bypass the lung filter.
The microbubbles sometimes created in the last phase of the dive during decompression are usually trapped and eliminated by the lung. Under the above mentioned conditions, bubbles dispersed in the venous blood may cross into the left atrium via the PFO without being filtered, enter the arterial circulation and allow other tissues resaturation.
Also if the volume of the bubbles increases due to reduced external pressure or due to their coalescence followed by the activation of biochemical processes in the blood, embolization into various organs may occur. These emboli may lead to a diving accident if they reach critical localizations and provoke symptoms of a decompression illness (DCI) with unknown origin.

▶ The risk of DCI by diving with a PFO is extremely low.
Not the PFO per se but rather the circulating bubbles pose a risk to the diving.

RECOMMENDATIONS

- **If PFO unknown:**

– Routine screening for PFO is not recommended, neither for recreational nor for professional divers.

- **If PFO discovered by chance:**

– 1st grade PFO: recommendations are the same as for divers without a PFO.
– 2nd and 3rd grade PFO: diving according to "low bubble diving recommendations".

- **After a diving accident:**

– After an "undeserved DCI", a thorough evaluation of possible causes must be performed by a skilled diving physician.

– After completion of diving accident treatment, the fitness to dive must be re-evaluated according to the SUHMS manual recommendations.

– If the occurrence of a DCI can be attributed with high probability to the presence of a PFO, the diver is still fit to dive within the scope of "low bubble diving" recommendations.

– In case of a repeat incident, the diver is considered unfit to dive until another extensive evaluation of the underlying cause is performed.

– An eventual recommendation for PFO closure should be considered on a case-by-case base, weighing a potential benefit according to the diver's individual needs against the short- and long-term risks of the procedure. The cost coverage needs to be checked.

These recommendations correspond to the up-to-date opinion of our experts. This publication is subject to modifications and will be adjusted in case of new evidence.

15 RULES FOR "LOW BUBBLE DIVING"

– **To keep bubble formation low:**

1 **Don't go to the limit of a no-decompression dive.**
Don't perform dives with a decompression stop obligation.

2 **Maximum of two dives a day.**
One day per week without scuba diving.

3 **Perform a safety stop at 3-5 meters depth for at least 5-10 minutes.**

4 **Dive with a Nitrox, using air decompression tables or computer setting.**
Pay attention to oxygen toxicity!

5 **Avoid yo-yo dives.**
No repetitive entry into the 0-10 meter zone.

6 **Reduce surfacing speed to 5 meters per minute in the upper 10 meters.**

7 **Avoid the cold, dehydration and smoking.**

8 **Avoid intense skin warming after the dive.**
Sunbathing, hot shower, sauna and so forth.

9 **Surface interval of at least 4 hours before the next dive.**

10 **Perform the deep phase of the dive first.**

11 **At least a two-hour interval before moving to a higher altitude.**

12 **Special underwater computers or software may reduce the risk**.

– **To decrease the risk of bubble transfer into the arterial blood stream:**

13 **Avoid strenuous physical efforts during the last 10 meters of surfacing.** Avoid underwater work, fining or swimming against current at the end of the dive.

14 **Avoid exhausting physical activity during two hours following the dive.**
Do not inflate the buoyancy compensator by mouth on the surface.
Take off the SCUBA gear in the water and let it be lifted by helpers.
Do not climb the shore or into the boat strenuously, (no increase of intrathoracic pressure).
Avoid carrying heavy equipment.

15 **It is absolutely prohibited to dive when having a cold!**
Coughing and forced Valsalva maneuver facilitate bubble transfer into the arterial blood stream.

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