Introduction

Over the past decades diving has become more and more popular. With the necessary knowledge and skills diving is generally a safe and low-risk activity. Nevertheless, despite of all precautions decompression accidents are reported from time to time. Some studies have shown a link between the occurrence of unexplained decompression illness and an opening between the heart chambers, called a Patent Foramen Ovale (PFO).

St. Jude Medical is focused on reducing risk by continuously finding ways to put more control into the hands of those who save and enhance lives.
**What is decompression illness?**

During a dive, the body is exposed to changes in the surrounding pressure. This pressure change affects the gases contained within the body tissues and liquids, and which are normally exhaled through the lungs. When pressure reduces during the ascent, nitrogen will be released in the venous system in the form of little bubbles. Small amounts of nitrogen bubbles can easily be filtered by the lungs. However, if the proportion of bubbles is too large or bubbles are entering the arterial system, symptoms may appear. These symptoms are known as decompression illness (DCI) and may vary from joint pain and skin rashes to neurological symptoms.

Though small amounts of nitrogen bubbles are always present in the venous blood for up to two hours after surfacing, the absolute risk for having a DCI event is small and only 2.5 events per 10,000 dives\(^1\).

**What is a PFO?**

Patent Foramen Ovale (PFO) is a flap-like opening between the two upper chambers of the heart known as the left and right atrium. A PFO is present in ~27% of the population\(^2\). PFO is not a heart defect; it is a remnant of the fetal blood circulation. In the womb, all babies have this opening because it allows circulation of the blood during pregnancy. However, after birth this flap normally closes to form a solid wall, closing the PFO. The device then adjusts to the unique anatomy of the heart.

Endothelialization, or this process of tissue formation, is important because it helps prevent blood in the left atrium from reacting with the exposed device and forming clots (called thrombosis).

Soon after the device is implanted, tissue begins to form around the PFO closure device completely. Soon after the device is implanted, tissue begins to form around the PFO closure device completely. The device then adjusts to the unique anatomy of the heart.

**How is a PFO closed?**

Closing the PFO may prevent air bubbles from entering the arterial circulation through the PFO and forces the blood to be filtered by the lungs.

A PFO is typically closed with a minimally invasive, nonsurgical procedure during which a PFO closure device is implanted into the heart. Much safer than open-heart surgery, this procedure produces little discomfort and patients are generally able to leave the hospital the next day.

Most types of PFO closure devices consist of two anchors joined together. Starting with a catheter (a small, hollow tube) inserted into the femoral vein near the groin, the device is guided through this vein into the heart. Once in the heart, the anchors are deployed on either side of the septal wall, closing the PFO. The device then adjusts to the unique anatomy of the heart.

**Recommendations for divers**\(^4\)

**Novice Diver / Asymptomatic Diver**

Routine screening for PFO with TEE not mandatory*

**Diver with a history of unexpected DCI**

Screening for PFO and other cardiac right-to-left shunt with TEE necessary:

<table>
<thead>
<tr>
<th>PFO present</th>
<th>No PFO</th>
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<tbody>
<tr>
<td>If diving continued, consider the following measures:</td>
<td>- Consider other types of right-to-left shunt (shunt between venous and arterial circulation)</td>
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<td>- Strict adherence to decompression tables</td>
<td>- Use nitrox instead of compressed air</td>
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<td>- No repetitive dives during a day</td>
<td>- To minimize tissue nitrogen load</td>
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<td>- No deep dives (&gt;25-30m)</td>
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<td>- Reduced rate of ascent during last 10m</td>
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<tr>
<td>- No Valsalva maneuvers during ascent; no strenuous physical effort</td>
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<tr>
<td>- Use nitrox instead of compressed air</td>
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<tr>
<td>- PFO closure procedure</td>
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For more information, please visit sjm.com

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*New divers to be informed on potentially increased DCI risk with PFO

References