Title: Decompression Sickness: A Lesser-Known Cause of Portal Venous Gas

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Case presentation: 55-year-old male with past medical history of HTN, hyperlipidemia, anxiety who initially presented to an outside hospital (OSH) for headache, upper back pain, double vision, abdominal distention, abdominal pain, and nausea after scuba diving. No associated loss of consciousness, numbness, weakness, confusion, SOB, chest pain, and vision loss. He is a recreational spear fisherman with extensive dive experience and completed a total of 6 spearfishing scuba dives on Nitrox over the span of 2 days before symptoms onset. The only unexpected event during the course of the 6 dives was on his 1$^{st}$ dive on his 1$^{st}$ day of diving he became nauseated at 50 feet of seawater and rapidly ascended to the surface. His nausea resolved and no other symptoms developed, so he continued diving that day. The symptoms listed above onset within 15 minutes of exiting the water of his 6$^{th}$ total dive on the second day. During transport by boat back to shore, his double vision symptoms and headache resolved, while his other symptoms persisted. At the OSH to evaluate his symptoms a CT abdomen pelvis was obtained which showed portal venous gas, but no other abnormality, prompting consultation for emergent Hyperbaric Oxygen Treatment ($HBO_2$) due to concern for Decompression Sickness (DCS). He was discharged from the ED and drove by private vehicle to the nearest 24/7 hyperbaric chamber in New Orleans. On arrival at our facility his only persistent symptoms were abdominal distention, abdominal pain and upper back/right shoulder pain. He was treated with US Navy Treatment Table 6 without extensions for acute DCS. Post treatment his abdominal distention and pain were almost completely resolved, and his upper back/right shoulder pain was no longer present. He was offered an additional tailing hyperbaric treatment the following day, but initially declined this given his symptoms had largely improved / resolved. Overnight his abdominal pain/distention and upper back/right shoulder pain reoccurred prompting him to complete an additional tailing HBO2 at 2.0 Atmospheres Absolute (ATA) for 90 minutes. Post treatment his exam was reassuring again, and he stated his symptoms were essentially resolved, electing to return home. His symptoms did not recur post 2$^{nd}$ HBO treatment. We recommended an ECHO with bubble study to evaluate for an underlying patent foramen ovale (PFO) which resulted positive for PFO. His cardiologist recommended he undergo percutaneous closure.

Discussion: DCS is a potentially life-threatening condition that occurs when dissolved gases, most frequently nitrogen, form bubbles in the bloodstream and tissues as a result of changes in ambient pressure. Based on data from the Divers Alert Network, DCS in recreational divers has been reported at 3.6 cases per 10,000 dives, with 0.84 cases of neurological DCS per 10,000 dives. A PFO is a common clinical entity, occurring in approximately 25-30% of the general population and divers with a PFO are reported to have a 4-fold increased risk of DCS. Current consensus guidelines do not recommend routine screening for PFO in recreational or commercial divers without history of DCS due to the low absolute risk of serious DCS and the relatively high overall prevalence of PFO in the general population. For recreational divers that suffer a DCS incident, all should be advised to perform conservative dive practices to avoid future DCS incidents. However, in cases such as this one where the patient developed DCS after a relatively unprovocative series of dives and wants to continue diving without restrictions, evaluation for a PFO is warranted and if a PFO is detected, the recommendation would be for repair of the PFO prior to being cleared to return to unrestricted diving. DCS is considered a rare source of portal

venous gas with the leading causes being bowel necrosis (72%), ulcerative colitis (8%), intra-abdominal abscess (6%), small bowel obstruction (3%), gastric ulcer (3%). Several studies have shown the presence of portal veinous gas in DCS and postulate that it is more common than it was once thought, this is due to most DCS case evaluations do not involve imaging of the abdomen.