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INVESTIGATING THE INCIDENCE OF HEPATIC PORTAL VENOUS GAS IN RECREATIONAL DIVERS; A BENIGN PHENOMENON OR INDICATION OF DECOMPRESSION SICKNESS?

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Introduction: Previous investigators have documented venous gas emboli (VGE) in divers and animal models after a variety of dive profiles and hyperbaric exposures. Gas emboli in association with decompression sickness (DCS) have been described in various tissues but not to our knowledge within the abdominal viscera. Hepatic portal venous gas (HPVG) has been detected by ultrasound in a volunteer after an experimental dive, but historically it has not been associated with DCS. At a prior UHMS Annual Scientific Meeting (2007) we reported a case series of divers who presented with abdominal pain after diving who were noted to have HPVG on abdominal CT scans (Figure 1). The implications of these findings led to our hypothesis that HPVG may be radiographic evidence of DCS.

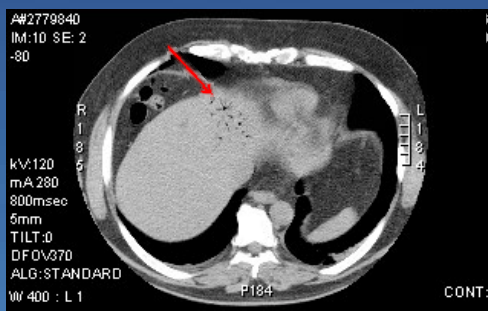


Figure 1: CT demonstrating HPVG

Objectives: The purpose of this study was to determine if HPVG could be detected in normal, healthy, asymptomatic SCUBA divers after completion of varying no-decompression dive profiles. If gas was detected in such a patient population, this would suggest that HPVG is merely a manifestation of tissue gas burden. If no HPVG was detected in this asymptomatic study cohort, this would suggest that HPVG may be objective radiographic evidence of DCS.

Methods: 26 recreational sports divers (17 men, 9 women) from the San Diego area participated in this study. 11 divers used specific dive parameters for a repetitive dive while the remaining 15 divers used similar parameters for a single dive. All divers used compressed air as their breathing gas. No divers in our study had a history of DCS. All profiles were no-decompression dives. After diving, the participants had blood drawn followed by a non-contrast abdominal CT scan within three hours of completing their final dive. We analyzed the incidence of HPVG as well as the incidence of elevated liver transaminases (AST, ALT) and creatine phosphokinase (CPK). Data analysis included frequency distributions of all study variables. These frequencies were used to describe demographic information (age, gender, etc.), number of dives, and the presence of HPVG or laboratory abnormalities in the study subjects.

Results: Diver characteristics are reported in Tables 1 and 2. Laboratory data are reported in Tables 3 and 4. Only 1 diver had mild elevation in ALT whereas 20 divers had mild elevations in CPK ranging from 180-388 U/L. No HPVG was detected in any of the divers from either of the dive groups (Table 5). A representative CT scan with no HPVG is seen in Figure 2.

Table 1: Diver Age

	Age
Mean	40.4
Min	24
Max	60

Table 2: Diver Experience

	Percent
Beg	15.4
Int	15.4
Adv	69.2

Table 3: ALT

	Frequency	Percent
High	1	3.8
Normal	25	96.2
Total	26	100

Table 4: CPK

	Frequency	Percent
High	20	76.9
Normal	6	23.1
Total	26	100

Table 5: CT Scans

	Frequency	Percent
Normal	26	100
HPVG +	0	0
Total	26	100

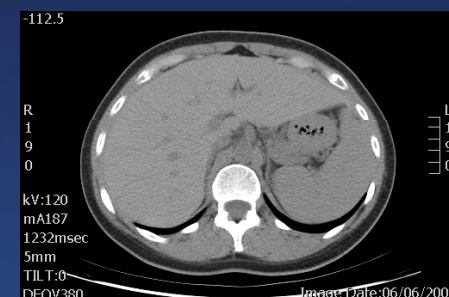


Figure 2: Normal CT demonstrating no HPVG

Conclusions: Although our sample size was small, these data are consistent with our hypothesis that HPVG may be a radiographic indicator of tissue gas burden and DCS. Further study with a larger cohort, including patients with DCS are needed to further evaluate any purported relationship between HPVG and DCS.

Limitations: Our number of subjects was small. No patients enrolled in the study had symptoms of DCS. The dive profiles completed were all well within the USN Navy no decompression limits. It is possible that none of the volunteers had a sufficient tissue gas burden to develop HPVG.

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