

Clinical Communications: Adults

PORTAL VENOUS GAS ON COMPUTED TOMOGRAPHY IMAGING IN PATIENTS WITH DECOMPRESSION SICKNESS

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Abstract—Background: It has been reported that portal venous gas is rarely found on computed tomography (CT) imaging in patients with decompression sickness (DCS). However, we propose that this is not true because we have encountered several patients with DCS who presented with portal venous gas on CT before hyperbaric oxygen therapy (HBOT). Here, we review our charts and present these patients' characteristics. **Cases:** We treated 37 patients with DCS from April 2007 to September 2011. Nine of these 37 patients underwent CT (thoracic, abdominal, or both) on admission because of dyspnea and other reasons. In four of nine patients, portal venous gas was incidentally found on CT. All patients were male, and three of them were SCUBA (self-contained underwater breathing apparatus) divers. Most of the patients did not have abdominal complaints. Three of four patients presented with gas in other abdominal areas (e.g., mesentery or inferior vena cava). HBOT (United States Navy Treatment Table 6) was performed in all patients, and abdominal CT performed after HBOT in three of four patients revealed the complete disappearance of portal venous gas and other venous gases. One patient died, and the remaining patients survived without any complications. **Conclusions:** Most patients with DCS do not require CT examination before HBOT. However, if all patients with DCS undergo abdominal CT, the presence of portal venous gas in these patients may no longer be a rare finding. Although routine CT is not required for patients with DCS, it might be helpful for diagnosis. © 2013 Elsevier Inc.

Keywords—portal venous gas; computed tomography; decompression sickness; hyperbaric oxygen therapy

INTRODUCTION

Doppler systems are most commonly used to detect gas bubbles in the venous circulation in divers (1–5). The first and only report of gas in the portal veins and inferior vena cava on abdominal computed tomography (CT) was by Bird in 2007 (6). Because CT is not suitable for the study of moving objects, it is difficult to detect bubbles in the blood with this procedure. Although most studies on venous gas–related decompression sickness (DCS) do not discuss portal venous gas, we have observed the presence of gas in the portal veins of several patients. Therefore, we propose that the reported rarity of this phenomenon is due to the nonrequirement for CT examination before hyperbaric oxygen therapy (HBOT) in most patients with DCS. We reviewed the charts of our patients with DCS to study this phenomenon.

CASE REPORTS

We treated 37 patients with DCS from April 2007 to September 2011. Nine of these 37 patients underwent CT (thoracic, abdominal, or both) on admission to evaluate their condition after near-drowning and for other reasons. In four of nine patients, hepatic portal venous gas was incidentally detected on the lower slices of thoracic or abdominal CT. These four patients' characteristics are summarized in Table 1, and the details of their clinical

Table 1. Patient Summary

Patient No.	Age (Years)	Sex	Maximum Depth/Stay Time	Method of Dive	Trouble During Dive	Symptoms	Location of Venous Gases	HBOT	Venous Gases after HBOT	Outcomes
1	49	Male	27 m/18 min	SCUBA	No	Vertigo, mild dyspnea	Portal vein	Table 6	Disappeared	Survival
2	51	Male	20 m/25 min	SCUBA	No	Vertigo, dyspnea	Portal vein Mesenteric vein	Table 6	Disappeared	Survival
3	61	Male	51 m/30 min	SCUBA	Yes	Conscious disturbance	Portal vein Mesenteric vein	Table 6	—	Death
4	64	Male	25 m/3 h	Surface-supplied	No	Syncope, general fatigue, mild dyspnea	Portal vein IVC	Table 6	Disappeared	Survival

HBOT = hyperbaric oxygen therapy; IVC = inferior vena cava; SCUBA = self-contained underwater breathing apparatus; Table 6 = United States Navy Treatment Table 6.

courses are described (images represent typical cases). Our hospital's institutional ethics committee approved this study.

Case 1

A 49-year-old man was transferred to our hospital by ambulance, presenting with vertigo and mild dyspnea after SCUBA (self-contained underwater breathing apparatus) diving. He had no complaints of abdominal pain. He was a professional diver and had performed two computer-assisted, nondecompression dives with compressed air, both of which were performed with safety stops. Thirty minutes after the end of his second dive, he experienced vertigo, headache, and mild dyspnea.

Upon admission to our hospital, the patient was alert and his vital signs were stable. Chest x-ray study findings were normal. Initial head and thoracic CT scans were performed 3 h after the conclusion of his second dive. These CT scans did not reveal abnormal findings in the brain, mediastinum, or lungs. However, because a lower slice of the thoracic CT showed portal venous gas, an abdominal CT was also performed. This abdominal CT showed diffuse intrahepatic portal venous gas. HBOT (United States [US] Navy Treatment Table 6) was administered. After the second HBOT session, the patient's symptoms and portal venous gas disappeared completely.

Case 2

A 51-year-old man was transferred to our hospital by ambulance, presenting with vertigo and dyspnea after SCUBA diving. He was a recreational dive instructor and had performed two computer-assisted, nondecompression dives with compressed air along with other recreational divers; both dives were performed with safety stops. He experienced vertigo and dyspnea 10 min after the conclusion of his second dive.

Upon admission to our hospital, the patient was alert and his vital signs were stable. Chest x-ray study findings were normal. Initial head and thoracic CT scans performed 2.5 h after the conclusion of his second dive revealed no abnormal findings in the brain, mediastinum, or lungs. Nonetheless, abdominal CT was performed because the lower slices of thoracic CT showed portal venous gas. This abdominal CT showed portal venous gas and mesenteric venous gas. HBOT (US Navy Treatment Table 6) was performed, after which his symptoms, portal venous gas, and mesenteric venous gas disappeared completely.

Case 3

A 61-year-old male occupational diver was transferred to our hospital by ambulance after nearly drowning and experiencing a severe consciousness disturbance while

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