



A case of intrahepatic portal venous gas with systematic gas findings by CT in decompression illness.

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Background:

Decompression illness (DCI) can occur in divers and compressed-air workers (incidence rate 0.05%). Although extra or intravascular bubbles are formed under inadequate decompression, it is difficult to detect gas using computed tomography(CT) or magnetic resonance imaging(MRI) in central nervous tissues, internal organs including blood vessels. We report a case of DCI with systemic gas detected by CT, and symptomatic improvement with elimination of abnormal CT findings by hyperbaric oxygen treatment(HBO).

Case presentation:

A 54-year-old man complained of strong abdominal pain 3 hours after decompression after caisson work at 0.17 MPa.

He has a history of diabetes and hypertension. He was admitted to the hospital with a diagnosis of acute abdominal pain. CT was performed which showed extensive intrahepatic gas, as well as gas in the pulmonary artery and bilaterally in the femoral veins (Fig.1).

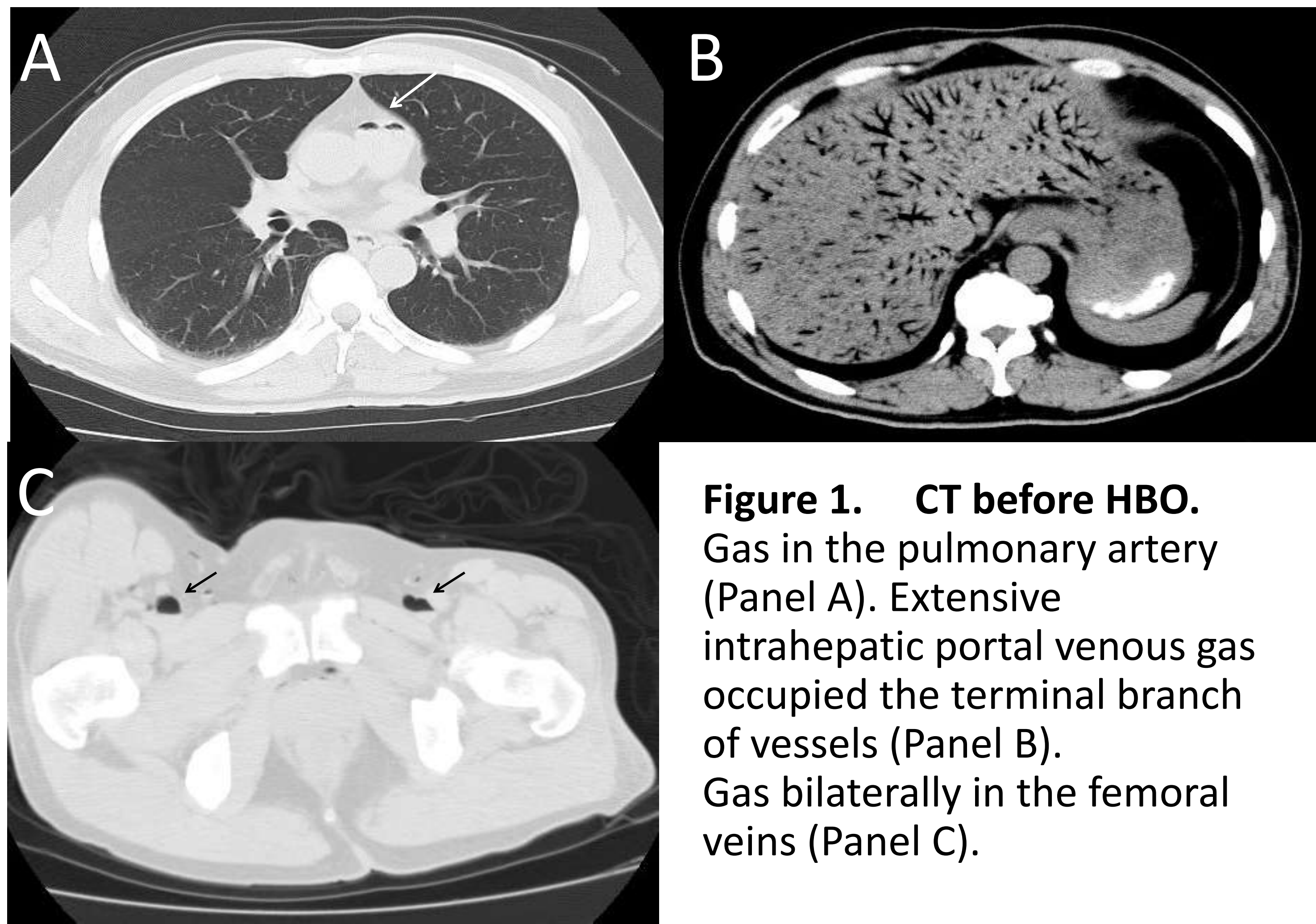


Figure 1. CT before HBO. Gas in the pulmonary artery (Panel A). Extensive intrahepatic portal venous gas occupied the terminal branch of vessels (Panel B). Gas bilaterally in the femoral veins (Panel C).

He was transferred to a hospital which has a monoplace chamber for HBO, 7 hours after the onset of pain. On administration, there was evidence of numbness bilaterally in the lower extremities and abdominal pain(Fig.2). There were no other neurological symptoms. A blood test showed elevated hemoglobin and hematocrit which indicate hemoconcentration (Table 1).

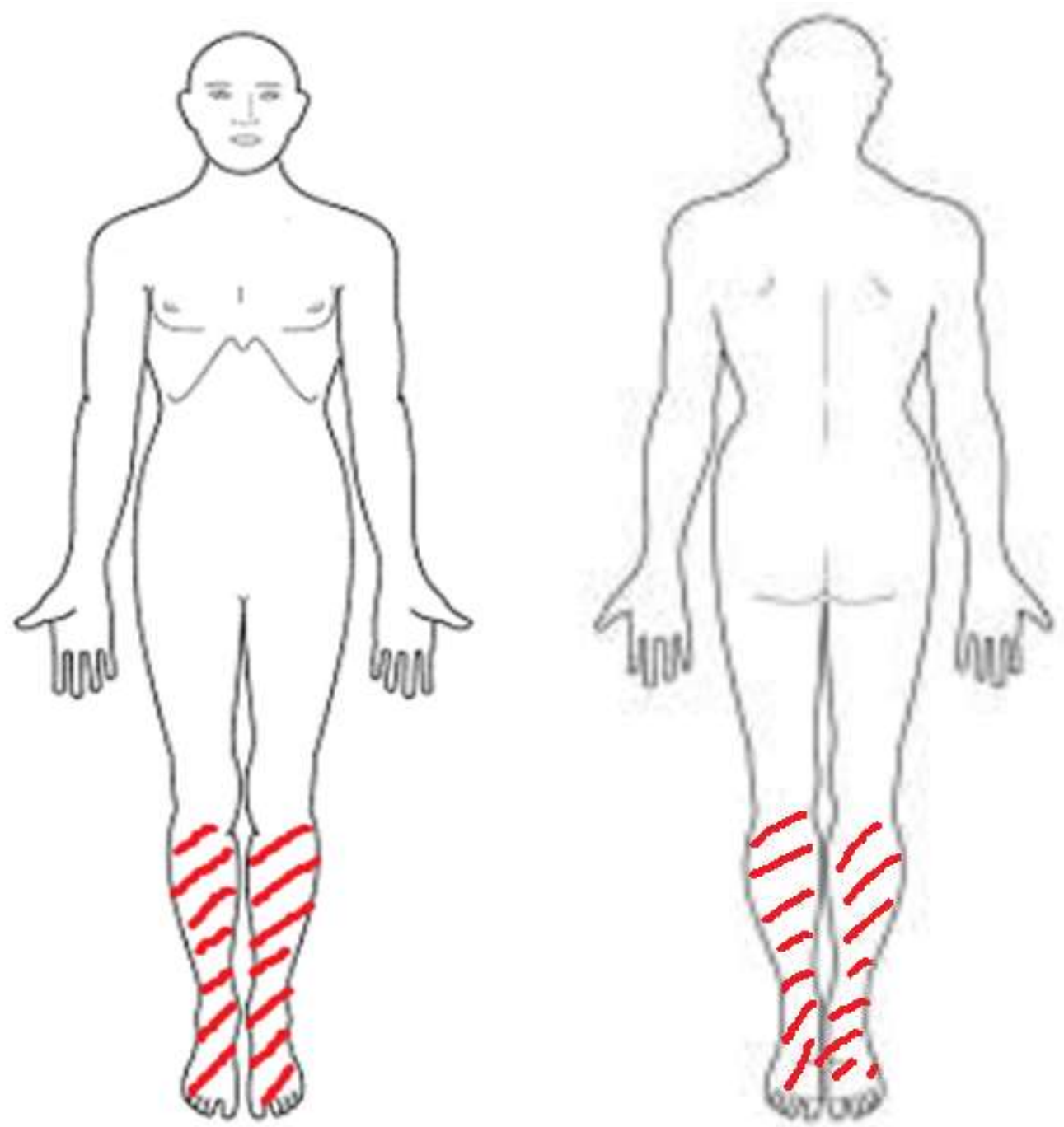


Figure2. Physical examination
Numbness in the bilateral lower extremities were observed.

| | Pre-HBO | Post-HBO | 1day | 2day | 3day |
|--------------------|---------|----------|-------|-------|------|
| WBC / μ l | 25600 | 22700 | 16400 | 10300 | 7700 |
| CRP mg/dl | 0.97 | 2.86 | 4.91 | 3.09 | 2.26 |
| Hb g/dl | 20.2 | 20.9 | 20 | 15.6 | 13.5 |
| Hct % | 56.8 | 60.1 | 57 | 45.2 | 38.8 |
| AST U/L | 17 | 25 | 23 | 18 | 23 |
| ALT U/L | 17 | 17 | 15 | 15 | 18 |
| BUN mg/dl | 28 | 30 | 36 | 31 | 22 |
| Cre mg/dl | 1.85 | 2.13 | 3.14 | 2.21 | 1.63 |
| BUN/Cre | 15.14 | 14.08 | 11.46 | 14.03 | 13.5 |
| CK U/L | 341 | | 1121 | 533 | 313 |
| PT-INR | 0.90 | | 0.94 | 0.92 | |
| D-dimer μ g/ml | 0.75 | | 1.07 | 0.72 | 4.32 |

Table 1. Blood test results
Elevation of Hb and Hct indicate hemoconcentration. Blood test shows delayed elevation of CRP, BUN, Cre and CPK levels.

He immediately underwent HBO (2.5ATA 180min). After the HBO treatment , abdominal pain and bilateral numbness in the lower extremities were disappeared. Abdominal CT was negative for gas in both the portal vein and right-sided vessels (Fig.3).



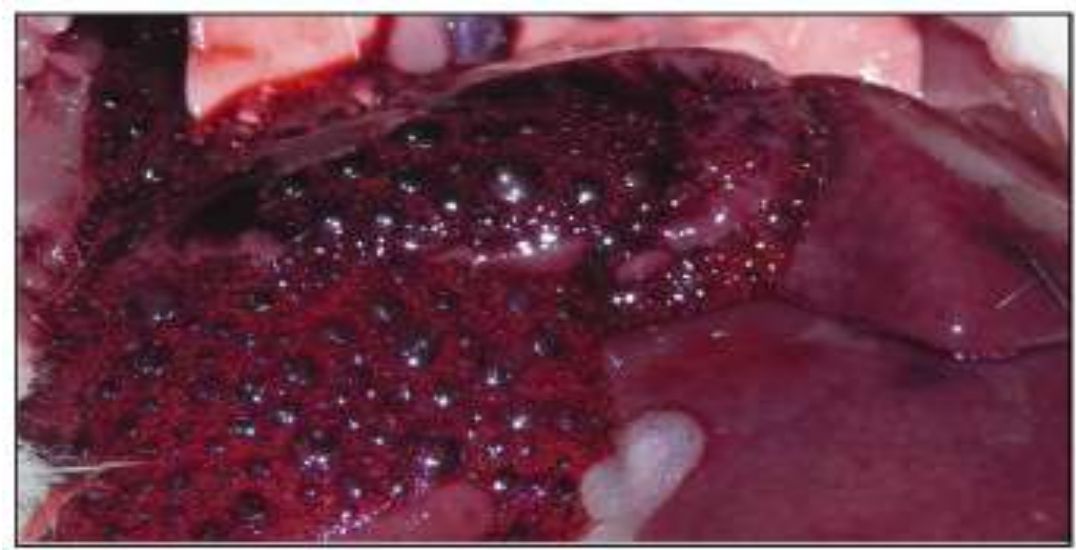
Figure 3. CT after HBO. After single HBO treatment, gas was not found in the right-sided vessels (Panel D,F) or in the portal vein (Panel E).

Transfusion therapy was continued until hemoconcentration improved. Blood tests showed delayed elevation of blood urea nitrogen(BUN), creatinine(Cre) and creatine phosphokinase(CPK) levels (Table 1). These indicated renal dysfunction and muscle damage caused by internal gas. Results from a blood test suggested rapid amelioration. He was discharged 3 days later without any subjective symptoms.

The patient was referred to our facility which has a multiplace HBO chamber. Upon the examination, Romberg's test remained positive and fluctuation remained. The diagnosis was that he did not completely recover from residual symptoms. He underwent additional HBO (US Navy TT6) treatment at our hospital. His residual symptom completely disappeared after additional TT6 treatments.

Discussion:

DCS occurs when dissolved gas emerge as pressure is reduced, forming gas bubbles within blood and tissues. Several studies have been reported the detection of gas bubbles in venous circulation by the use of Doppler systems.[1][2][3] On the other hand, only a few CT findings have been reported in the portal vein or inferior vena cava(IVC). [4][5] L'Abbate et al. reported gas embolization of the liver in a rat model of rapid decompression and suggested that the intestines are the major source of portal venous gas.[6]



Intrahepatic gas in rat
Gas embolization of the liver in a rat model of rapid decompression
Antonio L'Abbate et al. Am J Physiol Regul Integr Comp Physiol 299: R673–R682, 2010.

Our case demonstrates internal gas was detected in both the portal vein and in systemic venous circulation, which indicate gas from the intestines and blood. CT findings and blood tests suggest that abdominal venous gas emboli caused drastic abdominal pain and inflammation.

In this case, HBO with a monoplace chamber was the only choice of the treatment for emergent care of severe DCI. Immediate HBO reduced symptoms and gas drastically even though the treatment was not TT6.

Eventually patient still had symptom and TT6 was required. This suggests that HBO with TT6 is still the first choice of the treatment of DCI.

Summary:

- Clear visualization of gas in DCI patients is possible with CT.
- The current case demonstrate the effect of HBO; a significant reduction on systemic gas.
- TT6 is the first choice for DCI treatment.

Reference

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