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CE - MEDICAL ILLUSTRATION

# Ultrasound to evaluate effectiveness of hyperbaric oxygen therapy

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A 45-year-old man developed chest and abdominal pain, vomiting, and right-sided weakness after an accidental ingestion. Upon arrival in the emergency department (ED), the chest pain and weakness had resolved, and vital signs were unremarkable. The patient had persistent abdominal pain and vomiting refractory to antiemetics. An abdominal CT scan was remarkable for severe esophagitis and gastritis, portal venous air, and pneumatosis of the stomach wall with concern for impending gastric rupture. Bedside ultrasound (US) was performed (Fig. 1a). A treatment was administered, and a repeat US was obtained (Fig. 1b).

The patient reported drinking approximately 100 mL of 35 % $H_2O_2$ that was in an unlabeled water bottle in his refrigerator. $H_2O_2$ is available in both dilute (3–9 %) and concentrated (27.5–70 %) forms. Higher concentration $H_2O_2$ is typically used in the commercial setting, but is now available in health food stores as "hyperoxygenation therapy." Although small ingestions of dilute $H_2O_2$ typically cause only mild irritation, ingestions of higher concentrations $H_2O_2$ can result in significant caustic injury. In addition, each 1 mL 35 % $H_2O_2$ liberates approximately 100 mL oxygen upon interaction with tissue catalase, leading to a potential for air embolism and end organ ischemia even in accidental ingestions [1–3]. The use of $H_2O_2$ in closed spaces or under high pressure also transmits risk of embolization, and such complications have been reported after irrigation of surgical wounds with lower concentration (3 %) $H_2O_2$ [4, 5].

Hyperbaric oxygen therapy (HBOT) at 3 atmospheres was pursued. Thirty minutes prior to HBOT, bedside US demonstrated portal venous air (Fig. 1a). The pain resolved during HBOT, and repeat US 30 min after treatment showed resolution of portal venous air (Fig. 1b).

Indications for HBOT after $H_2O_2$ ingestion are not standardized. Though controversial, some recommend prophylactic HBOT for the presence of portal venous air [3]. In these cases, repeat CT imaging is often obtained to document resolution of air after HBOT, exposing patients to additional radiation. US may be an easy, radiation-free alternative to detect and show resolution of air in the cases of $H_2O_2$ ingestion.

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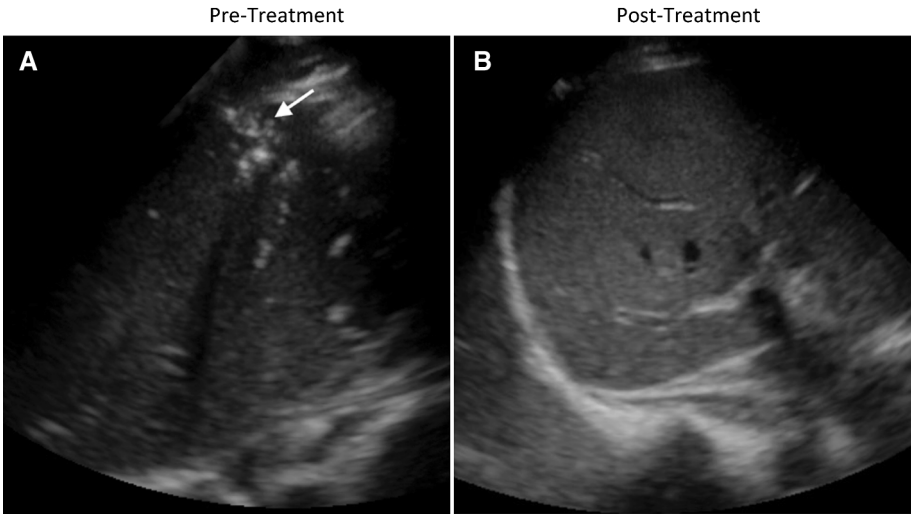


**Fig. 1** **a** The presence of portal venous gas in the liver. The *single arrow* points to a cluster of bright white specks that are an artifact created by the gas. Since gas does not transmit ultrasound waves, if enough gas is present, the ultrasound beam is blocked and shadowing can appear beyond the area, shown by *three parallel arrows*. **b** The same liver after HBOT. The air artifact is gone, and the liver parenchyma appears smooth and normal

**Compliance with ethical standards**

**Conflict of interest** The authors declare that they have no conflicts of interest.

**Statement of human and animal rights** The procedures followed were in accordance with the standards of the medical ethics committee and with the Helsinki Declaration of 1975, as revised in 2013.

**Informed consent** The patient signed informed consent.

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